

User's Manual

DSO-3000A
Series Oscilloscope

First Edition

www.leaptronix.com

Manual Print History

The manual print history shown below lists all the printing dates and editions. The printing date changes when a new edition is released. The latest editions can be downloaded from our website.

December 2009 First Edition

Warranty

This Leaptronix instrument product is warranted against defects in material and workmanship for a period of two years from the date of shipment. Other items such as test fixtures, test cables are warranted for 90 days from the date of shipment. During the warranty period, we will, at our option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Leaptronix. Purchaser shall prepay shipping charges to Leaptronix and Leaptronix shall pay for the return of the product to Buyer. However, Buyer shall pay all shipping charges, duties, taxes, and any other charges for products returned to Leaptronix from another country.

Limitation of Warranty

This warranty does not apply to defects resulting from improper or inadequate maintenance and care by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

No other warranty is expressed or implied. Leaptronix specially disclaims the implied warranties of merchantability and fitness for a particular use.

Leaptronix's responsibility to repair or replace defective products is the sole and exclusive remedy provided to the customer for breach of this warranty. Leaptronix shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Safety Precautions

The following safety precautions must be observed to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, read the operating information carefully before using the product and use this product only as specified.

NOTE: This product complies with INSTALLATION CATEGORY I as well as POLLUTION DEGREE 2.

This product is an INDOOR USE product.

- **Ground the Instrument**

Before operating the instrument, make sure the instrument chassis is grounded with the 3-pole power cable.

- **Don't operate in an explosive atmosphere**

To prevent explosion or fire, don't operate the instrument in the presence of inflammable gases or fumes.

- **Use the proper fuse**

Replace the broken fuse with the same type and rating for continuous protection against fire hazard.

- **Keep away from live circuits**

Don't remove the instrument covers when operating the

instrument. Component replacement and internal adjustment can only be done by qualified personnel. Don't replace components with the power cable connected. Dangerous voltage may remain even after the power cable has been disconnected. Always remove the power cable from the instrument and discharge circuits before touching them.

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1. Getting Started

Inspect Package Contents

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the oscilloscope has been checked mechanically and electrically.

Verify that you received the following items and any optional accessories you may have ordered.

- DSO-3000A Series Oscilloscope
- Two oscilloscope probes
- Power cord
- User's Manual

If the contents are incomplete, if there is mechanical damage or defeat, please contact us.

Getting Started

1. Trademark and Model

Indicate the oscilloscope model and trademark of the manufacturer.


2. Bandwidth and Sample Rate

Indicate the bandwidth and sample rate of the current oscilloscope model.


3. **MENU ON/OFF** Key

Press this key to toggle menu display on and off.

4. Key

Press the  key to read a previous or next page of the help information.

5. Entry Knob

The Entry knob is used to select items from menus and input values. Its function changes when different menu is displayed. The curved arrow symbol  above the Entry knob illuminates when the Entry knob is active and can be used to input a value or select a menu item.

When the Entry knob is inactive, the Entry knob can be used to adjust the intensity of the waveforms displayed on the screen.

6. **AUTO** Key

When you press the **AUTO** key, the oscilloscope will quickly

Getting Started

determine which channels are active, and it will turn these active channels on and scale them to display the input signals.

7. MENU Keys

When you press a menu key on the front panel, the oscilloscope will display the corresponding menu on the right side of the screen. The menu shows the options that are available when you press the softkeys directly to the right of the screen. There are totally five menu keys available:

UTILITY

Activate the system utility functions, such as System Setup, Language Setup, I/O Setup, and Print Setup etc.

MEASURE

Perform automated voltage and time measurements of displayed waveforms.

ACQUIRE

The ACQUIRE menu lets you set the oscilloscope to acquire in Normal, Peak Detect, or Average mode, and lets you select Real Time or Equivalent sampling.

SAVE/LOAD

You can save your current setup and waveform to the oscilloscope's internal memory or to an USB mass storage device, and then retrieve the setup or waveform later.

Getting Started

CURSOR

Press the **CURSOR** key to activate the cursors that you can use for making custom voltage or time measurement on scope signals.

DISPLAY

You can change the appearance of waveforms and the display screen, select the color schemes and adjust the brightness or intensity etc.

8. **RUN Control Keys**

The **RUN/STOP** key will illuminate in green when the oscilloscope is looking for a trigger. When the trigger mode is set to Normal mode, the display will not update until a trigger is found. If the trigger mode is set to Auto mode, the oscilloscope looks for a trigger, and if no trigger is found, it will be triggered automatically and the waveform of input signals will be showed immediately.

Press the **RUN/STOP** key again to stop acquiring data and the **RUN/STOP** key will illuminate in red. Now you can pan across and zoom in on the acquired waveform.

Press **SINGLE** key to make a single acquisition of data. The key will illuminate in yellow until the oscilloscope is triggered.

9. **Trigger Controls**

Getting Started

These controls are used to control how the oscilloscope triggers to capture waveforms.

10. Vertical Controls

You can use the vertical position control knob to move the waveforms up and down on the display. There is one vertical position control knob for each channel.

You can press the channel key **CH1** or **CH2** to switch the channel on or off, or access the channel's menu in the softkeys. There is one channel on/off key for each channel.

You can press the **MATH** key to access FFT (Fast Fourier Transform), multiply, subtract, and add functions.

You can press the **REF** key to save or load a reference waveform from the internal memory or external USB mass storage device.

You can use the vertical scale control knob to change the vertical scale of a waveform. The waveform display will contract or expand relative to the ground reference level. There is one vertical scale control knob for each channel.

11. Horizontal Controls

When the oscilloscope is running, the horizontal position control knob lets you set the acquisition window relative to the trigger point. When the oscilloscope is stopped, you can turn this knob to pan through the data horizontally. This let you see the

Getting Started

captured waveform before or after the trigger.

Press the horizontal **MENU** key to access the menu where you can split the oscilloscope display in Main and Delayed section, and where you can select X-Y and Roll modes.

Turn the horizontal sweep speed control knob to adjust the sweep speed. This changes the time base on the display. When adjusted after the waveform has been acquired and the oscilloscope is stopped, this has the effect of stretching out or squeezing the waveform horizontally.

12. Short-Cut Keys

These four short-cut keys: **TRIGSET**, **P/F**, **FFT** and **COUNTER** provide another quick direct approach to access the trigger SETUP, Pass/Fail, FFT menus, and hardware frequency counter function.

13. External Trigger Input

This is the external trigger input BNC connector.

14. Channel Input BNC

This is the channel's input BNC connector. Connect the oscilloscope probe or BNC cable to the BNC Connector.

15. Softkeys

Five softkeys are used to select control and parameter functions. Each softkey has a softkey label along its left side.

Getting Started

16. **PRINT Key**

Press this key to print the current waveform display to a USB mass storage device.

17. **Probe Compensation Terminals**

Use these two probe compensation terminals to match each probe's characteristics to the oscilloscope channel to which it is connected.

18. **USB Host Connector**

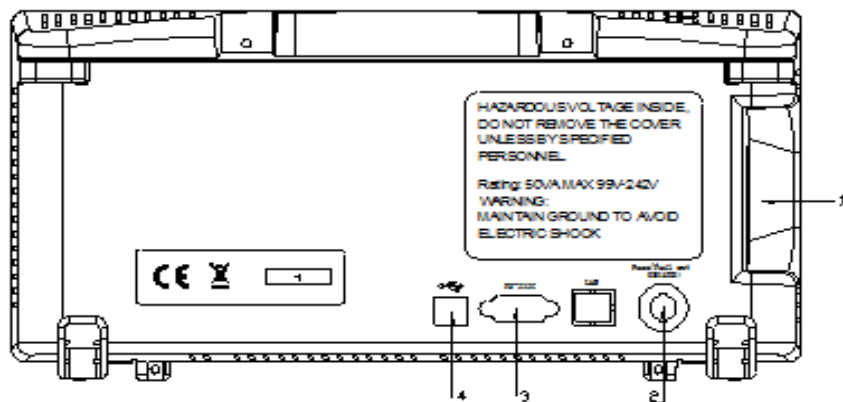
USB host connector can be connected to an USB mass storage device.

19. **LCD Display**

The 320*234 matrix (5.6 inch) color TFT LCD displays captured channel waveforms, setup information, measurement results and softkeys for setting up parameters.

Getting Started

Rear Panel



Rear panel

1. Line Input Receptacle

AC power cord receptacle. Attach to an AC power line with safety ground.

2. Pass/Fail Output Connector

Isolated Pass/Fail output connector, a pull-up resistor must be connected to output the Pass/Fail signal.

3. RS232 Interface Connector

RS232 interface connector can be connected to a controller or a computer.

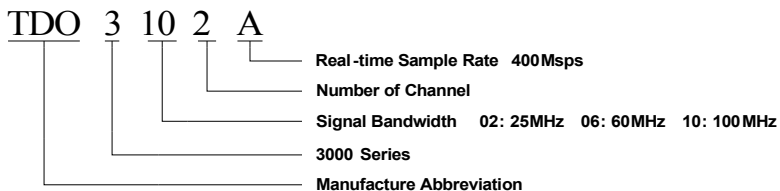
4. USB Device Connectors

USB device connector can be connected to a controller or a computer.

Getting Started

Naming Regulation

Take DSO-3102A as an example to describe the naming regulation of the DSO-3000A Series Oscilloscope.

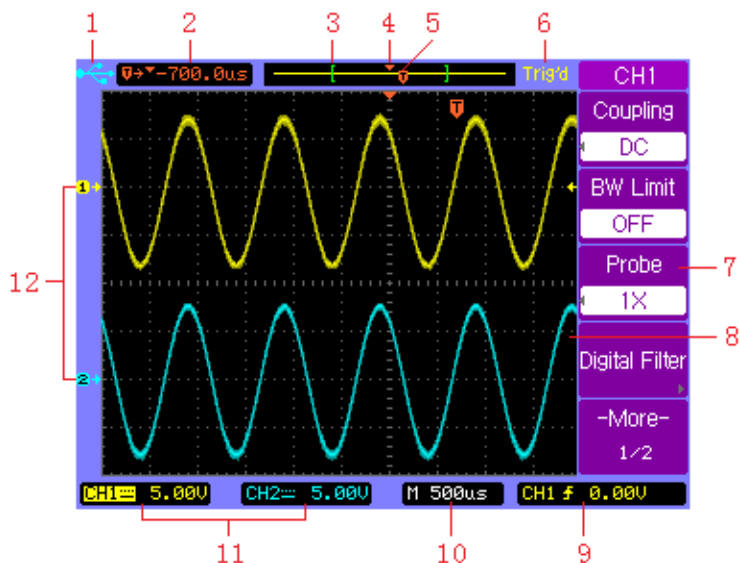


Naming regulation

Getting Started

Interpreting the Display

The oscilloscope display contains channel acquisitions, setup information, and softkeys for setting up parameter.



Interpreting the display

1. The USB icon illuminates when a USB disk is inserted and ready to be operated.
2. Readout shows the trigger position relative to the horizontal center of the screen.
3. The square brackets show the location of current display window within the whole record. The record line color

Getting Started

consists with the active waveform color.

4. Horizontal center position icon shows the horizontal center location within the record.
5. Trigger position icon shows the trigger location within the record.
6. Acquisition status readout shows AUTO, STOP, WAIT, Trig'd , Trig? or ROLL.
7. Softkey menu which allows you to set up additional parameters from front-panel softkeys.
8. The display area contains the waveform acquisitions, channel identifiers, trigger and ground level indicators. Each channel's information appears in corresponding color.
9. Trigger readout shows trigger information such as trigger source, trigger type as well as trigger level.
10. Horizontal readout shows the Main or Delayed time base.
11. Channel readouts show the scale factor, coupling, bandwidth limit, digital filter, and invert status.
12. Waveform baseline icons show the zero-volt level of the waveforms. The icon colors correspond to the waveform colors.

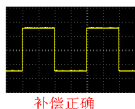
2. Basic Operation

Probe Compensation

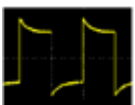
Perform this adjustment to match your probe to the input channel. This should be done whenever you attach a passive probe for the first time to any input channel. A poorly compensated probe can introduce measurement errors.

1. Set both the probe and the oscilloscope attenuation factor to X10 respectively.
2. Connect the oscilloscope probe to channel 1. Attach the probe tip and reference lead to the 3Vp-p@1kHz terminal and to the chassis terminal, then press **AUTO** key.
3. Use a nonmetallic tool to adjust the trimmer capacitor on the probe for the flattest pulse possible. The trimmer capacitor is located on the probe BNC connector.

Perfect compensated



Over compensated



Under compensated



Basic Operation

4. Connect probes to channel 2. Repeat the procedure. This matches each probe to each channel.

Using Quick Help

DSO-3000A Series Oscilloscope has a Quick Help system that provides help for each front-panel key and softkey.

Press and hold down the key or softkey for which you would like to view help information. The help information will be displayed and remain at the center of the screen as shown below until another key is pressed or a knob is turned.

If there are more help information pages, press the ◀▶ key to browse the previous or next pages.



Using Autoset

DSO-3000A Series Digital Storage Oscilloscope provides the Autoset function which sets the vertical, horizontal, and trigger controls properly and automatically.

Autoset function detects, turns on, and scales any channel with a repetitive waveform that has a frequency of at least 50Hz, a duty cycle greater than 0.5%, and an amplitude of at least 10mV peak-to-peak. Any channels that do not meet these requirements are turned off.

When you are using more than one channel, the Autoset function sets the vertical controls for each channel and used the channel 1 to set the horizontal and trigger controls.

To configure the oscilloscope quickly and automatically, press the **AUTO** key to display the connected signals that are active.

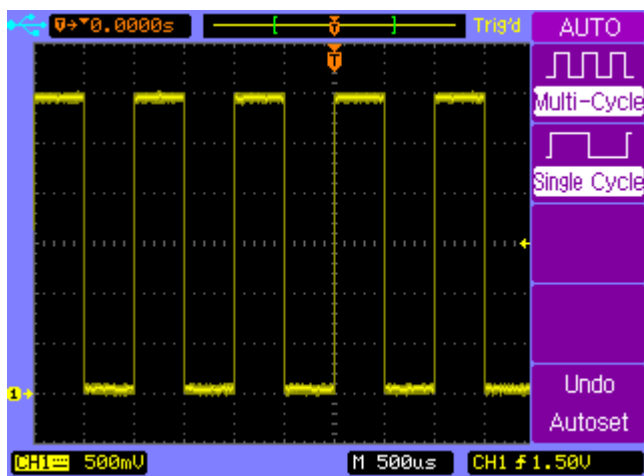
To configure the oscilloscope to display multiple cycles, press **Multi-Cycle** softkey in the **AUTO** menu.

To configure the oscilloscope to display a single cycle, press **Single Cycle** softkey in the **AUTO** menu.

To undo the effects of Autoset, press the **Undo Autoset** softkey in the **AUTO** menu before pressing any other key. This is useful when you have unintentionally pressed the **AUTO** key or do not

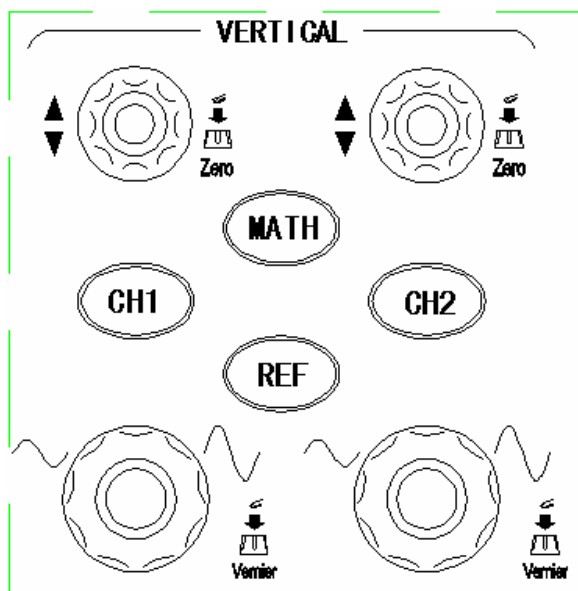
Basic Operation

like the settings Autoset has selected and want to return to your previous settings.



Autoset of oscilloscope channel 1

Vertical Controls



Vertical controls

Vertical Position Control (CH1, CH2)

Turn the small vertical position knob above the channel key to move the channel's waveform and its ground level icon (⏏) up or down on the display. The voltage value momentarily displayed in the bottom left portion of the display represents the voltage difference between the vertical center of the display and the ground level(⏏).

Basic Operation

Press the small vertical position knob above the channel key to bring the channel's waveform and its ground level icon (Ⓜ➔) directly back to the vertical center of the display.

Channel Key **CH1**, **CH2**, **MATH**, **REF**

Press the channel key from the front panel to display the channel's menu and turns the display of the channel on or off. The channel is displayed when the key is illuminated.

You must be viewing the menu of a channel before you can turn it off. For example, if CH1 and CH2 are both displayed and the **CH2** menu is now displayed. In order to turn **CH1** off, you should press the **CH1** key first and **CH1** menu will be displayed, then press **CH1** key again to turn off **CH1**.

Vertical Scale Control (**CH1**, **CH2**)

Turn the large vertical scale knob below the channel key to set the scale factor for the channel. The vertical scale knob changes the channel scale in a 1-2-5 step sequence. The channel scale factor value is displayed in the bottom left portion of the display.

Press the large vertical scale knob to toggle between Fine and Coarse. When fine is selected, you can change the channel's vertical sensitivity in smaller resolution. When coarse is selected, the vertical scale knob changes the channel scale in a 1-2-5 step sequence.

Basic Operation

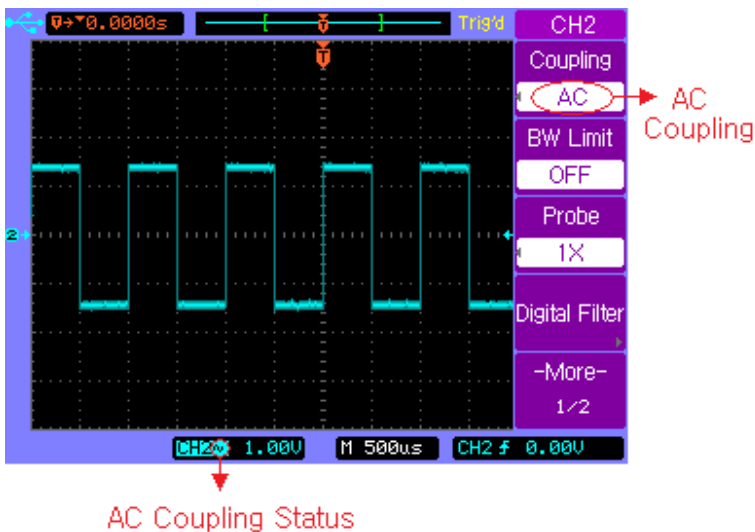
CH1, CH2 Menu

Press the channel key **CH2** to display the channel's menu and turns the display of the channel on.

Channel Coupling

Press the channel key **CH2**, then press the **Coupling** softkey to select AC coupling mode.

AC coupling places a high pass filter in series with the input signal that blocks the DC component of the input signal. AC coupling is useful for viewing waveforms with large DC offsets.

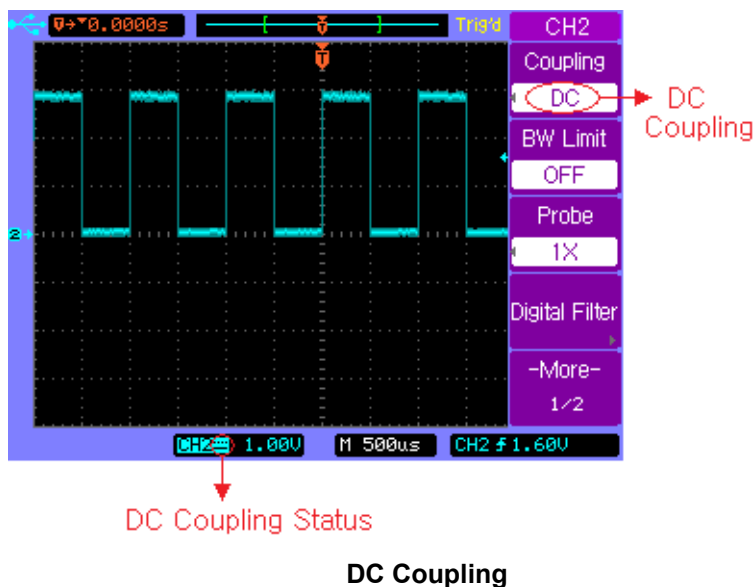


AC Coupling

Basic Operation

Press the channel key **CH2**, then press the **Coupling** softkey to select DC coupling mode.

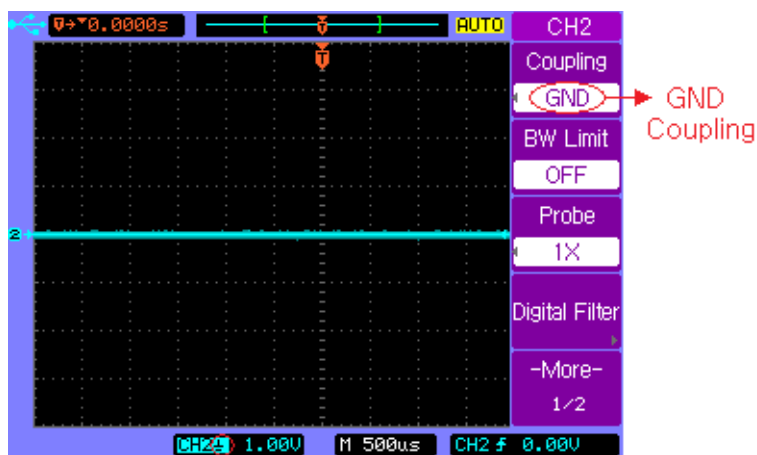
DC coupling passes both AC and DC components of the input signal. DC coupling is useful for viewing low frequency waveforms that do not have large DC offsets.



Basic Operation

Press the channel key **CH2**, then press the **Coupling** softkey to select GND coupling mode.

GND mode blocks both AC and DC components of the input signal and connect the input to the ground level.



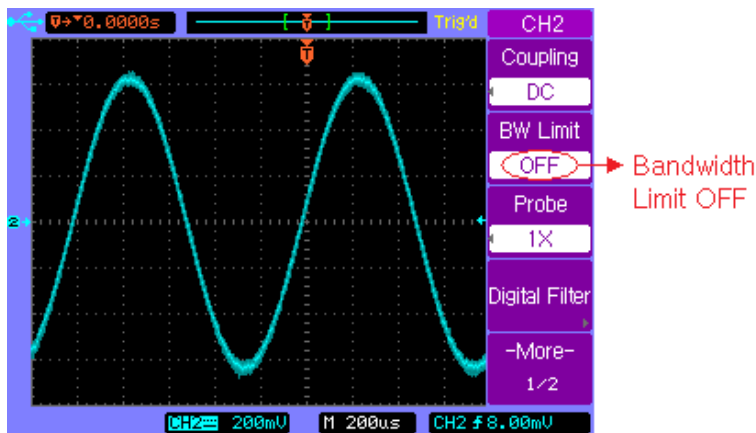
GND Coupling Status

GND Coupling

BW Limit

When BW Limit is on, the maximum bandwidth for the channel is approximately 20MHz. For waveforms with frequencies below this, turning bandwidth limit on removes unwanted high frequency noise from the waveform. The bandwidth limit also limits the trigger signal path of any channel that has **BW Limit** turned on.

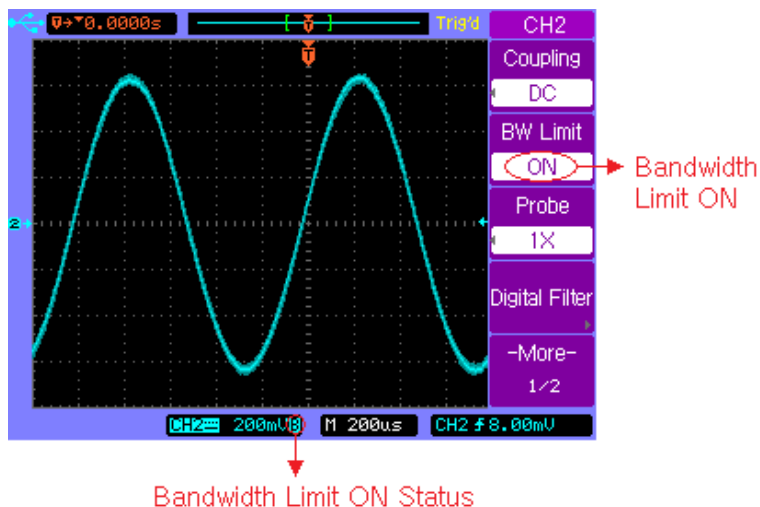
Press the channel key **CH2**, then press the **BW Limit** softkey to turn the bandwidth limit off for the selected channel 2. BW Limit off mode passes both the high and low frequency components.



BW Limit off

Basic Operation

Press the channel key **CH2**, then press the **BW Limit** softkey to turn the bandwidth limit on for the selected channel 2. BW Limit on mode blocks the high frequency components over 20MHz.



BW Limit on

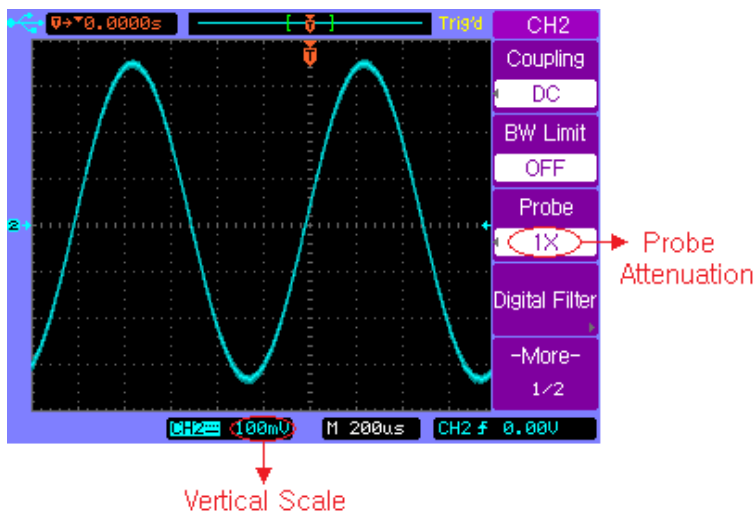
Basic Operation

Probe Attenuation Setting

Probes are available with various attenuation factors which affect the vertical scale of the signal. You can manually select the factor that matches the attenuation of your probe.

For example, to match a probe set to 10X connected to CH2, press the channel key **CH2**, and then press the **Probe** softkey and select 10X.





Press the channel key **CH2**, then press the **Probe** softkey and select 1X, when a probe with 1:1 attenuation factor is connected to CH2.




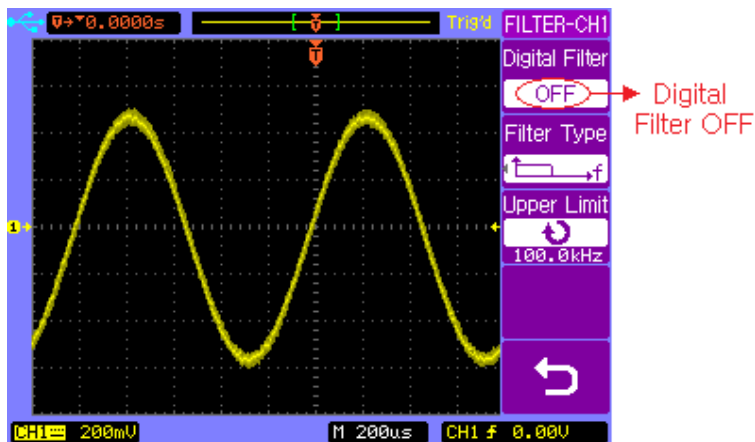
Set Probe Attenuation Factor to 1X

Digital Filter

Press the channel key **CH1**, then press the **Digital Filter** softkey to display the **FILTER-CH1** menu. Four kinds of filter types are available:

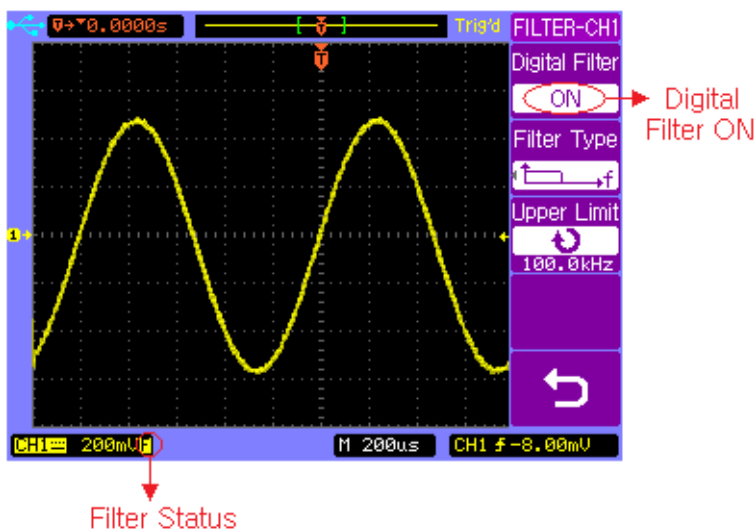
-  Low pass filter
-  High pass filter
-  Band pass filter
-  Band block filter

Press the **Upper Limit** or **Lower Limit** softkey and then adjust the Entry knob  to set the high and low frequency range for the filter.



Digital Filter is off

Basic Operation

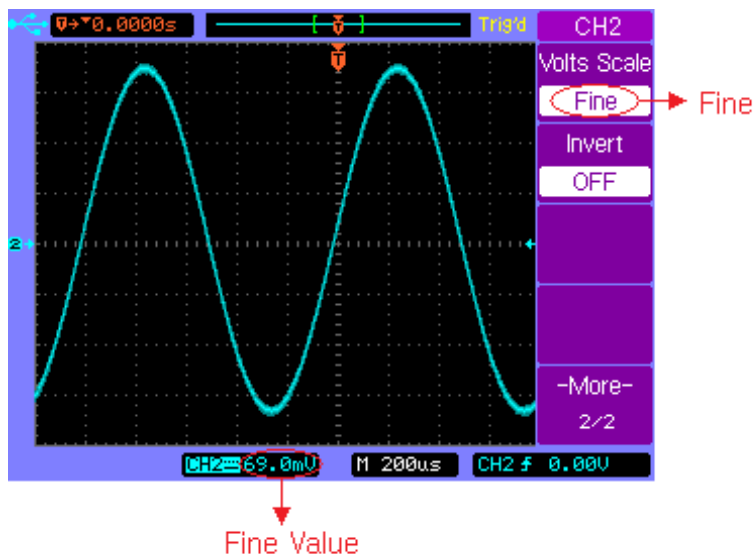


Digital Filter is on

Vertical Scale

Turn the large vertical scale knob below the channel key to set the scale factor for the channel. The channel scale factor value is displayed in the bottom left portion of the display.

Press **CH2** → **More 1/2** → **Volts Scale** to select **Coarse** or **Fine** adjustment. You can also press the large vertical scale knob to toggle between **Fine** and **Coarse**. When Coarse is selected, the vertical scale knob changes the channel scale in a 1-2-5 step sequence. When Fine is selected, the vertical scale knob changes the channel scale in a smaller resolution.

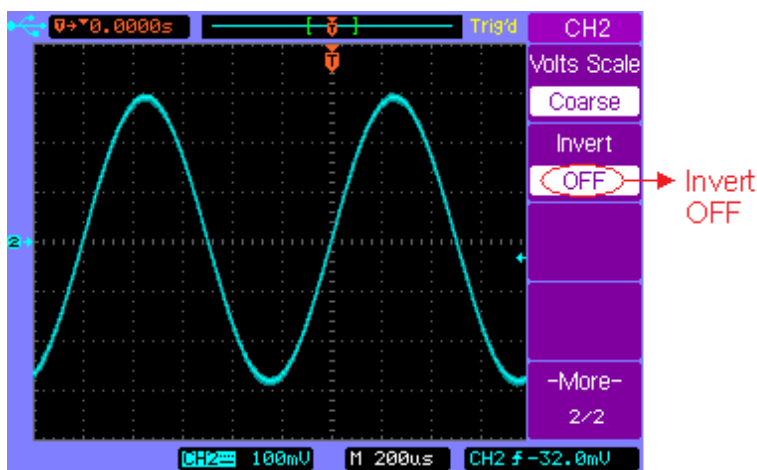


Fine Vertical Scale

Vertical Invert

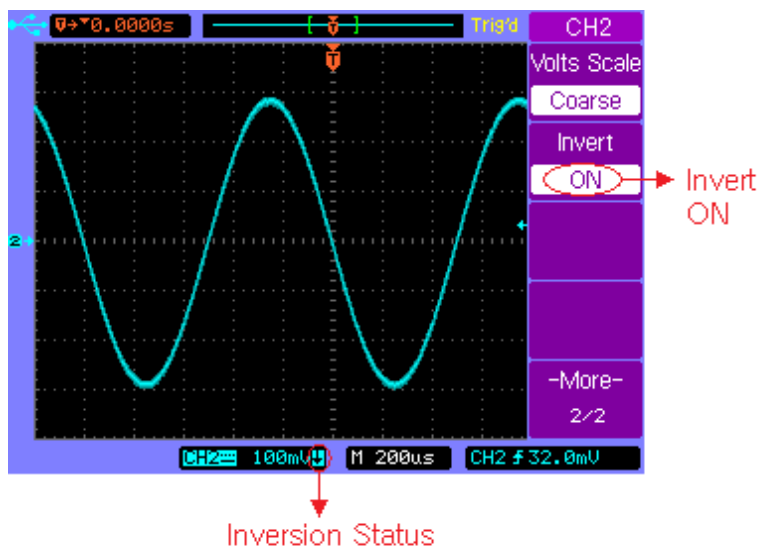
Press **CH2** → **More 1/2** → **Invert** to set Invert on or off. When Invert is turned on, the voltage values of the displayed waveform are inverted. Invert affects how a channel is displayed, but does not affect triggering. If the oscilloscope is set to trigger on a rising edge, it remains set to trigger on the same edge after the channel is inverted.

Inverting a channel will also change the result of any math function selected in the **MATH** menu or any measurement.



Vertical Invert off

Basic Operation



Vertical Invert on

MATH Functions




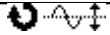




Dual Waveform Calculation

Press **MATH** channel key to turn on the **MATH** menu page 1/2.

| MATH | Softkey | Options | Description |
|----------|-----------------|---------|------------------------|
| Operate | Operate | A+B | Add A and B |
| A+B | | A-B | Subtract B from A |
| Source A | | A×B | Multiply A by B |
| CH1 | | FFT | Access FFT menu |
| Source B | Source A | CH1 | Select CH1 as Source A |
| CH2 | | CH2 | Select CH2 as Source A |
| Invert | Source B | CH1 | Select CH1 as Source B |
| OFF | | CH2 | Select CH2 as Source B |
| -More- | Invert | ON | Math invert ON |
| 1/2 | | OFF | Math invert OFF |
| | More 1/2 | ---- | Select page 2/2 |

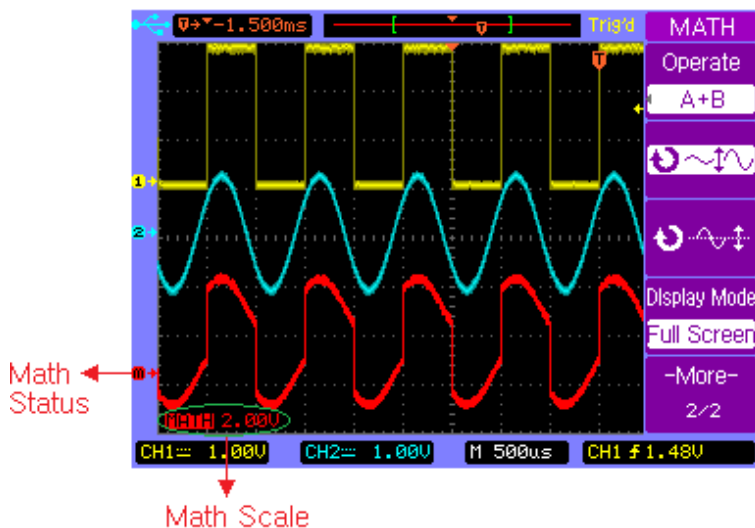
Basic Operation

Press softkey **More 1/2** to display **MATH** menu page 2/2.

| MATH | Softkey | Options | Description |
|---|---|---|---|
| Operate | Operate | A+B | Add A and B |
| A+B | | A-B | Subtract B from A |
|  | | $A \times B$ | Multiply A by B |
|  | | FFT | Access FFT menu |
|  |  |  | Vertical scale control |
|  |  |  | Vertical position control |
| Display Mode | Display Mode | Split Screen | Split the display into Main and Math sections |
| Full Screen | | Full Screen | Display Math waveform in full screen |
| -More- 2/2 | More 2/2 | ---- | Select page 1/2 |

Basic Operation

For example, we select the A+B math function, select CH1 as the Source A, and select CH2 as the Source B, then we will get the math waveform like this.



Math A+B

Basic Operation

FFT Spectrum Analysis

You can use the FFT function to measure harmonic component and distortion in systems, to characterize noise in DC power supplies and to analyze vibration.

Press **MATH** channel key to turn on the **MATH** menu page 1/2, and then press **Operate** softkey to select FFT. The **FFT** menu page 1/2 will be displayed.

Press softkey **More 1/2** to display **FFT** menu page 2/2.

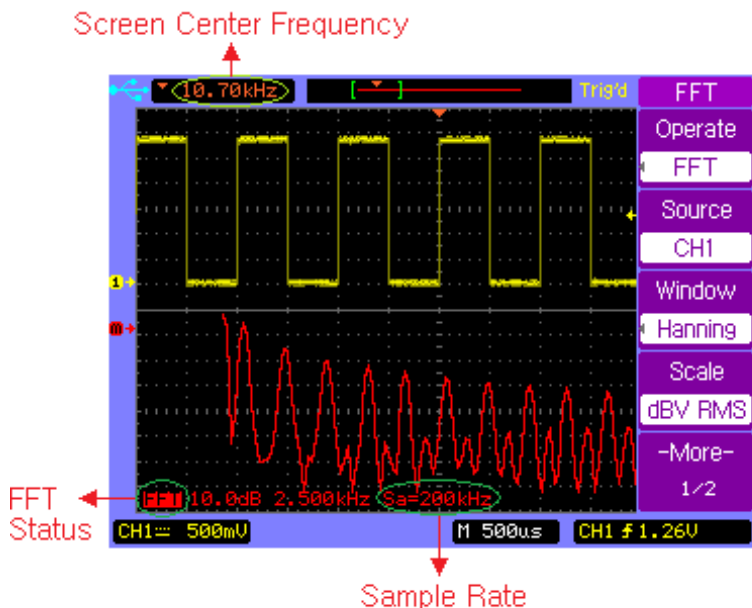
| | | | |
|-------------|-----------------|----------------|---------------------------|
| FFT | Softkey | Options | Description |
| Operate | Operate | A+B | Add A and B |
| FFT | | A-B | Subtract B from A |
| Source | | A×B | Multiply A by B |
| CH1 | | FFT | Access FFT menu |
| Window | Source | CH1 | Select CH1 for FFT |
| Rectangular | | CH2 | Select CH2 for FFT |
| Scale | Window | Rectangular | Use Rectangular window |
| V RMS | | Hanning | Use Hanning window |
| -More- | | Hamming | Use Hamming window |
| 1/2 | | Blackman | Use Blackman window |
| | | Flattop | Use Flattop window |
| | Scale | dBV RMS | Vertical scale in dBV RMS |
| | | V RMS | Vertical scale in V RMS |
| | More 1/2 | ---- | Select page 2/2 |

Basic Operation

| | | | |
|--|---------------------|----------------|---|
| <div>FFT</div> <div>Operate</div> <div>FFT</div> <div></div> <div></div> <div></div> <div>Display Mode</div> <div>Full Screen</div> <div>-More-</div> <div>2/2</div> | Softkey | Options | Description |
| | Operate | A+B | Add A and B |
| | | A-B | Subtract B from A |
| | | $A \times B$ | Multiply A by B |
| | | FFT | Access FFT menu |
| | | | Vertical scale control |
| | | | Vertical position control |
| | Display Mode | | |
| | Full Screen | Split Screen | Split the display into Main and Math sections |
| | | Full Screen | Display Math waveform in full screen |
| | More 2/2 | ---- | Select page 1/2 |

Basic Operation

For example, we select CH1 as the source for FFT, select Rectangular window, set vertical scale to dBV RMS, and then we will get the FFT waveform like this. We can also measure the amplitude and frequency of the corresponding point with the manual cursors.


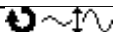

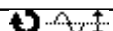



FFT Spectrum Analysis

REF Function


You might make measurement on a known good system, save the result to the internal memory or to an USB mass storage device, then make the same measurement on a test system and recall the reference waveform to see the difference.

Press **REF** channel key to turn on the **REF** menu page 1/2.

|  | Softkey | Options | Description |
|---|---|---|-------------------------------|
| | Source | CH1 | Save CH1 as reference |
| | | CH2 | Save CH2 as reference |
| |  |  | REF vertical scale control |
| |  |  | REF vertical position control |
| | Volts Scale | Coarse | Coarse vertical scaling |
| | | Fine | Fine vertical scaling |
| | More 1/2 | ---- | Select page 2/2 |

Basic Operation

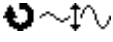

Press softkey **More 1/2** to display **REF** menu page 2/2.

|  | Softkey | Options | Description |
|---|-------------------------|---------------|---|
| | Invert | ON | REF invert ON |
| | | OFF | REF invert OFF |
| | Internal Storage | INTERNAL menu | Save the reference waveform to the internal memory. |
| | External Storage | EXTERNAL menu | Save the reference waveform to the USB mass storage device. |
| | More 2/2 | ---- | Select page 1/2 |

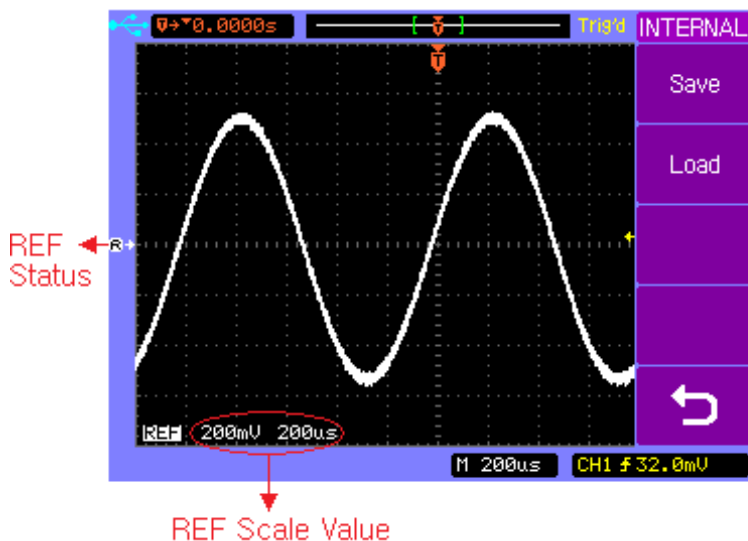
Press **REF** channel key to turn on the **REF** menu page 1/2, press softkey **More 1/2** to display **REF** menu page 2/2. Load the latest saved reference waveform from the internal memory or locate and load reference waveform file from the external memory.

You can use the horizontal position and scale control knob to change the time base of the reference waveform.

Basic Operation

Press  or  softkey and turn the Entry knob to change the vertical scale or position of the reference waveform.

Press **REF** → **Internal Storage** → **Save** to save the waveform of the Source channel as the reference waveform to the internal memory.

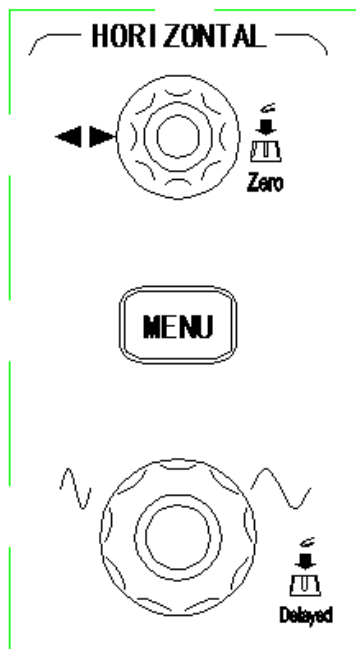


Save a Reference waveform

Note: The reference waveform function is unavailable when X-Y mode is selected.

Horizontal Controls


Use the horizontal controls to adjust the time base, adjust the trigger location, and to examine waveform details more closely.






Horizontal Controls

Horizontal Position Control

When the oscilloscope is running, this control lets you set the acquisition window relative to the trigger point. When the oscilloscope is stopped, you can turn this knob to pan through the data horizontally. This lets you see the captured waveform before the trigger or after the trigger.

The trigger position is marked with the indicator “” at the top of the graticule and also in the waveform record icon at the top of the screen.

The small inverted triangle () is the time reference indicator. When you change the horizontal scale, the waveforms contract or expand about this point.

Press the horizontal position control knob key to set the time delay to zero, and the trigger position indicator () overlays the time reference indicator().

Note: The horizontal position control is unavailable when X-Y horizontal mode is selected.

Horizontal Scale Control

Use the horizontal scale control to adjust the time base. The scale expands or contracts around the center of the screen. The horizontal scale factor can be set in a 1-2-5 sequence.

Basic Operation

Press the horizontal scale control knob to toggle between Main and Delayed horizontal display mode.

Horizontal **MENU** key

Press the horizontal **MENU** key to display the **HORIZONTAL** menu. This menu lets you select the horizontal mode: **Main**, **Delayed**, **Roll**, or **X-Y**.

Press the horizontal **MENU** key to display the **HORIZONTAL** menu page 1/2.

| HORIZONTAL | Softkey | Options | Description |
|---------------|-----------------------|---------|---------------------|
| Main ✓ | Main | ✓ | Main mode is ON |
| | | ---- | Main mode is OFF |
| Delayed | Delayed | ✓ | Delayed mode is ON |
| | | ---- | Delayed mode is OFF |
| X-Y | X-Y | ✓ | X-Y mode is ON |
| | | ---- | X-Y mode is OFF |
| Roll | Roll | ✓ | Roll mode is ON |
| | | ---- | Roll mode is OFF |
| -More- 1/2 | -More- 1/2 | ---- | Select page 2/2 |

Basic Operation

Press softkey **More 1/2** to display the **HORIZONTAL** menu page 2/2.

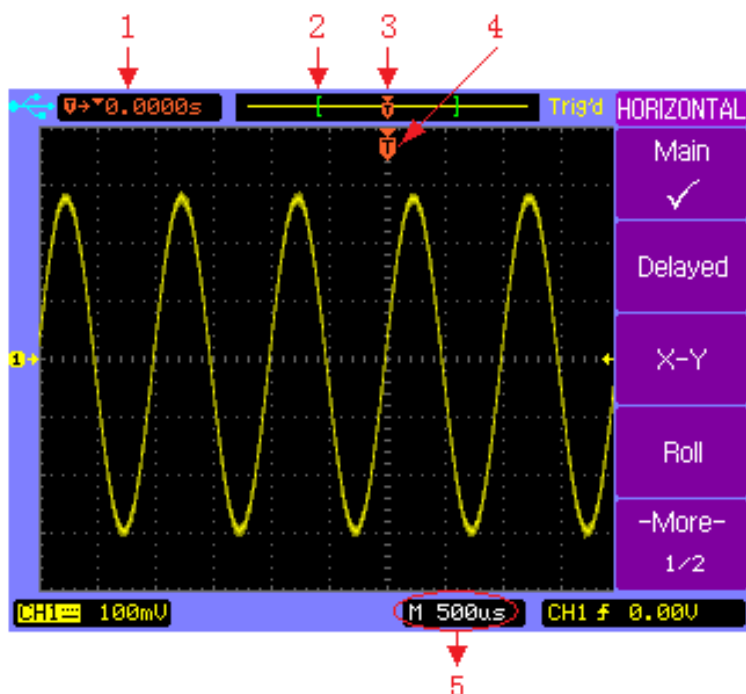
| HORIZONTAL Trig-Offset Reset -More- 2/2 | Softkey | Options | Description |
|--|------------------------------------|---------|-------------------------------|
| | Trig-Offset Reset | ---- | Reset the delay time to zero. |
| | -More- 2/2 | ---- | Select page 1/2 |

Main Horizontal Mode

Main horizontal mode is the normal viewing mode for the oscilloscope. When the oscilloscope is stopped, you can use the horizontal controls to pan and zoom the waveform. When the oscilloscope is running in Main mode, use the horizontal scale knob to change horizontal scale factor and use the horizontal position knob to set the delay time. When the oscilloscope is stopped, use the horizontal control knobs to pan and zoom the waveform. The time base (second/division) value is displayed at the bottom of the screen.

Press the horizontal **MENU** key and then press the **Main** softkey to select the main horizontal mode.

Basic Operation



Main Horizontal Mode

1. Readout shows the delay time or the trigger location within the record relative to the time reference point (\blacktriangledown).
2. The square brackets show the location of current display window within the record.
3. Trigger position within the record.
4. Trigger position on the current waveform display window.

Delayed Horizontal Mode

Delayed horizontal mode is an expanded version of main mode. When Delayed mode is selected, the display divides in half. The top half of the display shows the normal waveform and bottom half displays the delayed waveform.

Delayed waveform is a magnified portion of the normal waveform. You can use delayed waveform to locate and horizontally expand part of the normal waveform for a more detailed analysis of signals.

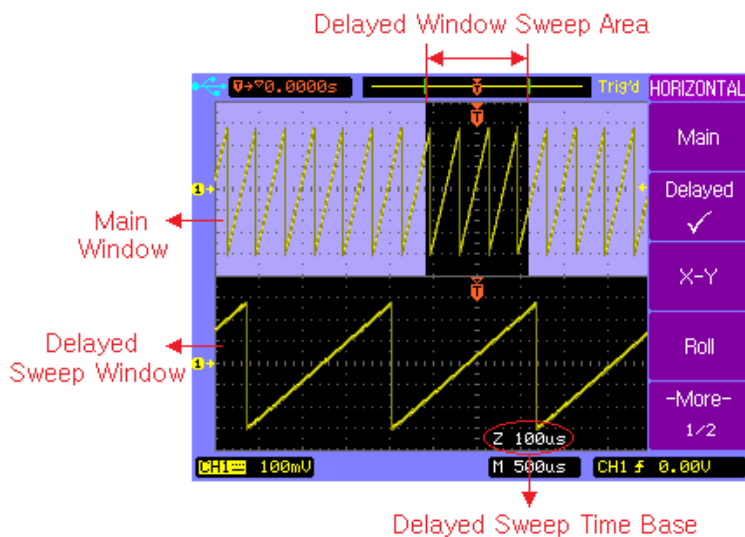
The area of the normal display that is expanded is marked on each end with a vertical shadow area. The unshadowed area shows what portion of the normal waveform is expanded in the lower half.

To change the time base for the delayed window, turn the horizontal scale knob. As you turn the knob, the time base for the delayed window is displayed just above the main time base.

To change the time base for the normal window, press the Main softkey, then turn the horizontal scale control knob.

Connect a triangle signal source to CH1, press the horizontal **MENU** key and then press the **Delayed** softkey to enter the Delayed mode. You can also press the horizontal scale control knob key to toggle between Main and Delayed mode directly.

Basic Operation



Delayed Horizontal Mode

X-Y Horizontal Mode

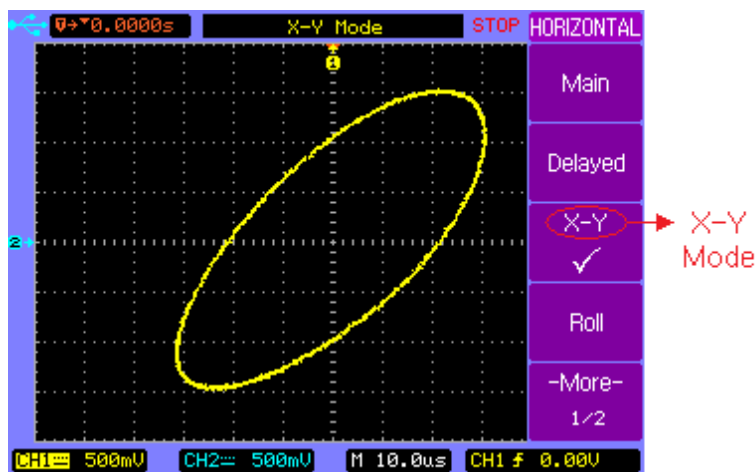
X-Y mode changes the display from a volts-versus-time display to a volts-versus-volts display. The time base is turned off. CH1 amplitude is plotted on the X axis and CH2 amplitude is plotted on the Y axis.

You can use X-Y mode to compare frequency and phase relationships between two signals. X-Y mode can also be used with transducers to display strain versus displacement, flow versus pressure, volts versus current, or voltage versus frequency.

In order to get a better view of the waveform, proper vertical scale should be selected before enter the X-Y mode.

Use X-Y mode to compare two signal with same frequency and different phase. Connect the two signal to CH1 and CH2 respectively. Press horizontal **MENU** key and then **X-Y** softkey to select X-Y mode.

Basic Operation



X-Y Horizontal Mode

Roll Horizontal Mode

Roll mode causes the waveform to move slowly across the screen from right to left. It only operates on time base settings of 500 ms/div or slower. If the current time base setting is faster than the 500 ms/div limit, it will be set to 500ms/div when Roll mode is selected.

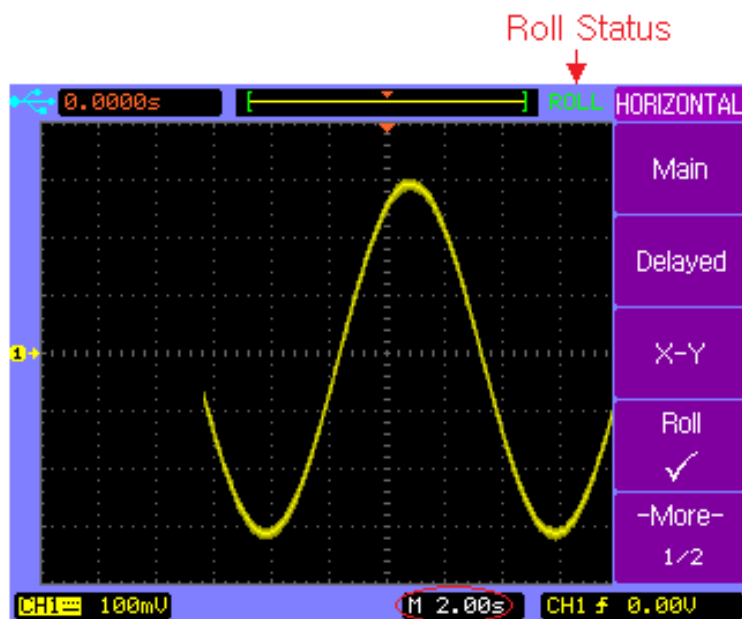
In Roll mode there is no trigger. The fixed reference point on the screen is the right edge of the screen and refers to the current moment in time. Events that have occurred are scrolled to the left of the reference point. Since there is no trigger, no pre-trigger information is available.

If you would like to pause the display after a full screen of acquisition in Roll mode, press the **SINGLE** key. To clear the display and restart another full screen acquisition in Roll mode, press the **SINGLE** key again.

Use Roll mode on low-frequency waveforms to yield a display much like a strip chart recorder. It allows the waveform to roll across the display.

Press the horizontal **MENU** key and then press the **Roll** softkey to select the Roll mode. The waveform moves slowly across the screen from right to left. The fastest time base is 500 ms in roll mode.

Basic Operation

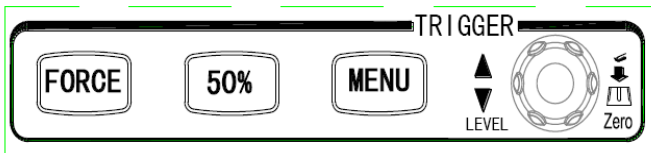


Horizontal Time Base

Roll Horizontal Mode

Trigger Controls

The trigger controls determine when the oscilloscope starts to acquire and display the waveform. When a trigger is found, the oscilloscope will acquire sufficient data to display the waveform. Trigger controls are functional when the oscilloscope works under Main or Delayed horizontal mode.



Trigger Controls

Trigger Control **MENU** key

Press the trigger control **MENU** key to show the **TRIGGER** menu and then press the **Type** softkey to select Edge, Pulse or Video.

Set to 50% key

Press the **50%** key to set the trigger level to the 50% amplitude level of the trigger source waveform.

Force Trigger key

Press the **FORCE** key to force an immediate trigger event, even in the absence of a signal. This function is useful in following situations.

If you do not see a waveform on the screen when using Normal trigger mode, press the **FORCE** key to acquire the signal baseline to verify that it is on the screen.

After you press the **SINGLE** key to set up for a single shot acquisition, you can press the **FORCE** key to do a practise acquisition to verify the control settings.

Trigger Level Control

Use the trigger level control knob to adjust the trigger level. When you change the trigger level, a horizontal red line temporarily appears to show you the level position on screen.

Basic Operation

After the line disappears, the trigger level is marked with a small left arrow.

Auto and Normal Trigger Modes

Press the trigger **MENU** key to display the **TRIGGER** menu and press the **Mode** softkey to select Auto or Normal trigger mode.

Auto mode

Use the auto trigger mode for signals other than low-repetitive-rate signals and for unknown signal levels. To display a DC signal, you must use Auto trigger mode since there is no edge to trigger on.

When you press **RUN/STOP** key to start acquiring, the oscilloscope first fill the pre-trigger buffer. It starts to search for a trigger after the pre-trigger buffer is filled, and continues to flow data through this buffer while it searches for the trigger. While searching for the trigger, the oscilloscope overflows the pre-trigger buffer; the first data put into the buffer is the first pushed out. When a trigger is found, the pre-trigger buffer will contain the events that occurred just before the trigger. If no trigger is found, the oscilloscope generates a trigger and displays the data as though a trigger had occurred. In this case, the background of the Auto indicator at the top of the display will flash, indicating that the oscilloscope is force triggered.

When you press the **SINGLE** key, the oscilloscope will fill the

pre-trigger buffer, and continue to flow data through the pre-trigger buffer until the Auto trigger overrides the searching and forces a trigger. At the end of the trace, the oscilloscope will stop and display the results.

Normal mode

Use Normal trigger mode for low repetitive-rate signals or when Auto trigger is not required.

In Normal mode the oscilloscope must fill the pre-trigger buffer with data before it will begin searching for a trigger event. While searching for the trigger, the oscilloscope overflows the pre-trigger buffer; the first data put into the buffer is the first pushed out.

When the trigger event is found, the oscilloscope will fill the post-trigger buffer and display the results. If the acquisition was initiated by **RUN/STOP**, the process repeats. If the acquisition was initiated by **SINGLE**, then the acquisition stops.

In either Auto or Normal mode, the trigger may be missed. This is because the oscilloscope will not recognize a trigger event until the pre-trigger buffer is full.

Holdoff Function

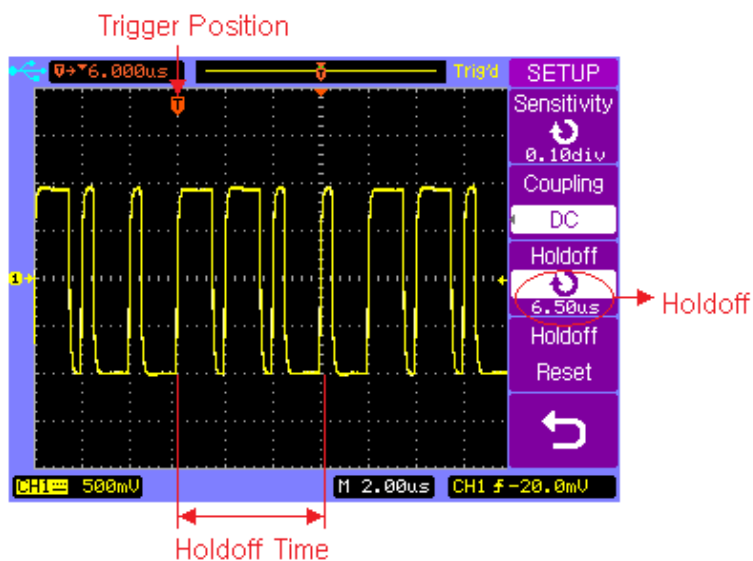
Holdoff sets the amount of time that the oscilloscope will wait before rearming the trigger circuit. You can use the holdoff function to stabilize the display of complex waveforms.

With the holdoff function, you can synchronize triggers. The oscilloscope will trigger on one edge of the waveform, and ignore further edges until the holdoff time is up. The oscilloscope will then rearm the trigger circuit to wait for the next edge trigger. This allows the oscilloscope to trigger on a repeating pattern in a waveform.

Turn the Entry knob to increase or decrease the trigger hold off time shown in the Holdoff softkey.

To get a stable trigger on the pulse burst shown on the screen, set the holdoff time to be slightly less than the period of the pulse burst.

Basic Operation






Holdoff Function

Edge Trigger

Use the Edge triggering to trigger on the rising or falling edge of the input signal at the trigger threshold.

Basic Operation

Press trigger control **MENU** key to display the **TRIGGER** menu, then press **Type** softkey to select Edge trigger.

| <div> <div>TRIGGER</div> <div>Type</div> <div>Edge</div> <div>Source</div> <div>CH1</div> <div>Slope</div> <div></div> <div>Mode</div> <div>Auto</div> <div>Trigger</div> <div>Setup</div> </div> | Softkey | Options | Description |
|--|---------------|---|-------------------------------------|
| | Type | Video | Video triggering |
| | | Edge | Edge triggering |
| | | Pulse | Pulse width triggering |
| | Source | CH1 | Trigger on CH1 |
| | | CH2 | Trigger on CH2 |
| | | EXT | Trigger on EXT |
| | | EXT/5 | Trigger on EXT/5 |
| | | AC Line | Trigger on AC line signal |
| | | Alternating | Trigger on CH1 and CH2 alternately |
| | Slope |  | Rising edge of a signal |
| | |  | Falling edge of a signal |
| | Mode | Auto | Trigger even without a valid event. |
| | | Normal | Trigger only on a valid event |










Pulse Width Trigger

Pulse width triggering sets the oscilloscope to trigger on a positive or negative pulse of a specified width from 20ns to 10s.

Basic Operation

Press trigger control **MENU** key to display the **TRIGGER** menu page 1/2, then press **Type** softkey to select Pulse trigger.



| Softkey | Options | Description |
|--------------------|---|-------------------------|
| Type | Video | Video triggering |
| | Edge | Edge triggering |
| | Pulse | Pulse width triggering |
| Source | CH1 | Trigger on CH1 |
| | CH2 | Trigger on CH2 |
| | EXT | Trigger on EXT |
| | EXT/5 | Trigger on EXT/5 |
| | Alternating | CH1 and CH2 alternately |
| Pulse Mode |  | Positive greater than |
| |  | Positive equal |
| |  | Positive within |
| |  | Positive less than |
| |  | Negative greater than |
| |  | Negative equal |
| |  | Negative within |
| |  | Negative less than |
| Pulse Setup |  | Set the pulse width |
| More 1/2 | ---- | Select page 2/2 |

Basic Operation

Press trigger control **MENU** key to display the **TRIGGER** menu, press **Type** softkey to select Pulse trigger and then press the **More 1/2** softkey to display **TRIGGER** menu page 2/2.

| TRIGGER | Softkey | Options | Description |
|---------------|---------------|---------|-------------------------------------|
| Type | Type | Video | Video triggering |
| Pulse | | Edge | Edge triggering |
| Mode | | Pulse | Pulse width triggering |
| Auto | Mode | Auto | Trigger even without a valid event. |
| Trigger Setup | | Normal | Trigger only on a valid event |
| -More- 2/2 | Trigger Setup | ---- | Select trigger SETUP menu. |
| | More 2/2 | ---- | Select page 1/2 |



Video Trigger

Choose video triggering to trigger on the odd fields, even fields, or on all the lines of a NTSC, PAL/SECAM video signal.

Basic Operation

Press trigger control **MENU** key to display the **TRIGGER** menu, then press **Type** softkey to select Video trigger.



| Softkey | Options | Description |
|-----------------|---|------------------------------------|
| Type | Video | Video triggering |
| | Edge | Edge triggering |
| | Pulse | Pulse width triggering |
| Source | CH1 | Trigger on CH1 |
| | CH2 | Trigger on CH2 |
| | EXT | Trigger on EXT |
| | EXT/5 | Trigger on EXT/5 |
| | Alternating | Trigger on CH1 and CH2 alternately |
| Polarity |  | Positive polarity |
| |  | Negative polarity |
| Sync | Odd Field | Trigger on odd fields |
| | Even Field | Trigger on even fields |
| | All Lines | Trigger on all lines |
| | Line # | Trigger on specific line. |
| More 1/2 | ---- | Select page 2/2 |





Basic Operation

| | | | |
|----------------|----------------------|----------------|------------------------------------|
| TRIGGER | Softkey | Options | Description |
| Type | Type | Video | Video triggering |
| Video | | Edge | Edge triggering |
| Standard | | Pulse | Pulse width triggering |
| NTSC | Standard | NTSC | Trigger on NTSC signal |
| Mode | | PAL/SECAM | Trigger on PAL or SECAM signal |
| Auto | Mode | ┐┌ Normal | Trigger only on a valid event |
| Trigger Setup | | Auto | Trigger even without a valid event |
| -More- 2/2 | Trigger Setup | ---- | Select trigger SETUP menu. |
| | More 2/2 | ---- | Select page 1/2 |

Press softkey **More 1/2** to display the **TRIGGER** menu page 2/2.

Basic Operation

Press softkey **Trigger Setup** from the **TRIGGER** menu page 2/2 to display the trigger **SETUP** menu.

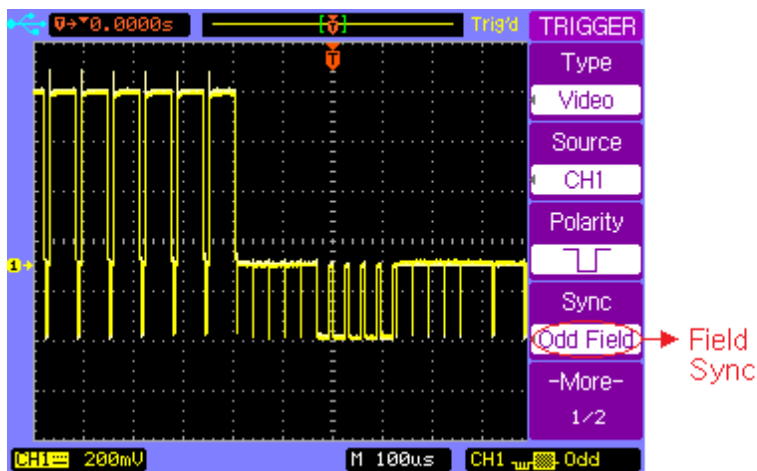
| SETUP | Softkey | Options | Description |
|---|---|-----------|--|
| Sensitivity  0.10div | Sensitivity | • | Set the trigger sensitivity by turning the entry knob |
| Coupling DC | Coupling | AC | AC coupling |
| | | DC | DC coupling |
| Holdoff  100ns | | LF Reject | Reject low frequencies |
| | | HF Reject | Reject high frequencies |
| Holdoff Reset | Holdoff | • | Set up the holdoff time between two consecutive triggers |
|  | Holdoff Reset | ---- | Reset the holdoff time to default value 100ns |
| |  | ---- | Return to the TRIGGER menu |

Note: You can display the trigger **SETUP** menu simply by pressing the short-cut key **TRIGSET** directly.

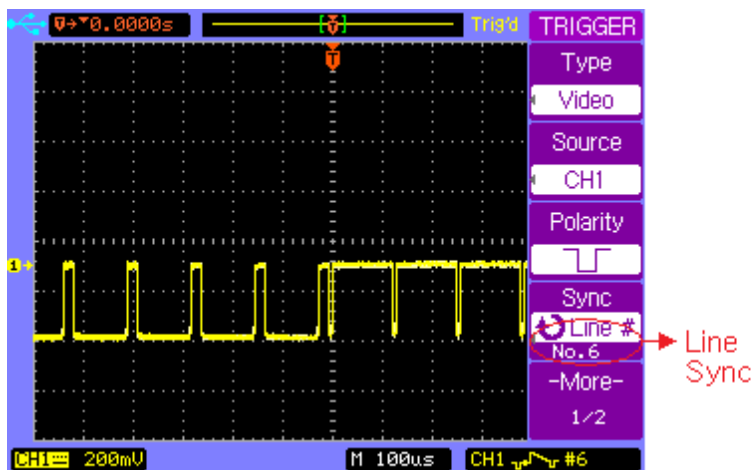
Note: There will be no coupling menu item when video trigger mode is selected in the trigger **SETUP** menu.

Basic Operation

Following figures show the video waveforms triggered on odd fields and specific line 6.



Trigger on odd fields

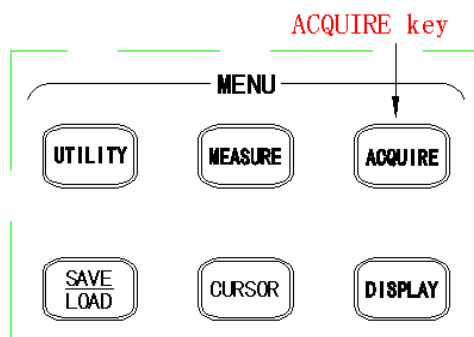


Trigger on specific line 6

Basic Operation

ACQUIRE Menu

Press the **ACQUIRE** menu key to show the **ACQUIRE** menu.



ACQUIRE Menu key

Normal acquisition mode yields the best display for most waveforms.

Average mode lets you average multiple triggers to reduce noise and increase resolution.


Peak Detect mode should be used to display narrow pulses that occur infrequently. It's useful when looking for very narrow pulses at very slow time base.

Equivalent sampling mode is useful to display high frequency repetitive signals.

Real Time sampling mode is useful to capture the single-shot signals.



Basic Operation

Press **Mode** softkey to select **Normal** mode.

|  A vertical stack of menu items. The top item is 'ACQUIRE' in a pink box. Below it are 'Mode', 'Normal', and an empty box, all in white boxes with a pink border. Then 'Sampling' and 'Equivalent' in white boxes with a pink border. Then another empty box. Finally 'Record' in a white box with a pink border. ACQUIRE Mode Normal Sampling Equivalent Record | Softkey | Options | Description |
|---|-----------------|-------------|-------------------------|
| | Mode | Normal | Normal acquisition. |
| | | Average | Average acquisition. |
| | | Peak Detect | Peak detect acquisition |
| | Sampling | Equivalent | Equivalent sampling. |
| | | Real Time | Real time sampling. |
| | Record | ---- | Select Record menu |

Basic Operation

Press **Mode** softkey to select **Average** mode.

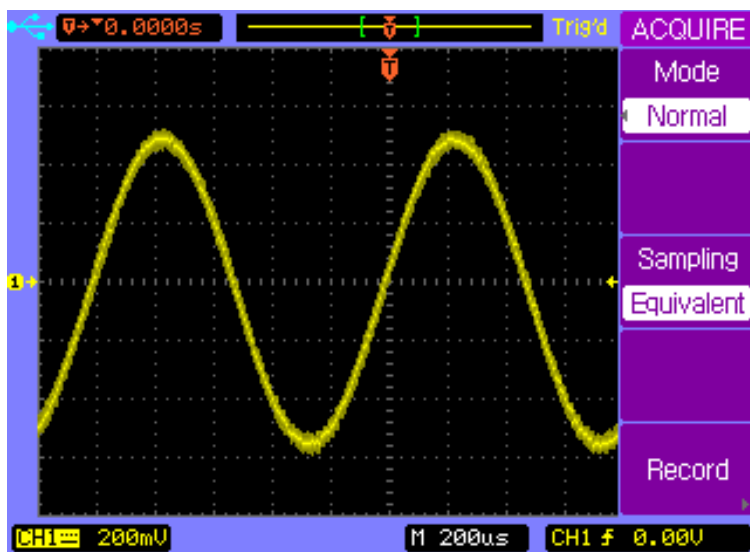
| <div style="background-color: #800080; color: white; padding: 2px;">ACQUIRE</div> <div style="background-color: #800080; color: white; padding: 2px;">Mode</div> <div style="background-color: #800080; color: white; padding: 2px;">Average</div> <div style="background-color: #800080; color: white; padding: 2px;">Averages</div> <div style="background-color: #800080; color: white; padding: 2px;">  16 </div> <div style="background-color: #800080; color: white; padding: 2px;">Sampling</div> <div style="background-color: #800080; color: white; padding: 2px;">Equivalent</div> <div style="background-color: #800080; color: white; padding: 2px;">Record</div> | Softkey | Options | Description |
|--|-----------------|---|---|
| | Mode | Normal | Normal acquisition. |
| | | Average | Average acquisition. |
| | | Peak Detect | Peak detect acquisition |
| | Averages |  | Set the average number to 2, 4, 8, 16, 32, 64, 128, or 256. |
| | Sampling | Equivalent | Equivalent sampling. |
| | | Real Time | Real time sampling. |
| | Record | ---- | Select Record menu |

Press **Mode** softkey to select **Peak Detect** mode.

| <div style="background-color: #800080; color: white; padding: 2px;">ACQUIRE</div> <div style="background-color: #800080; color: white; padding: 2px;">Mode</div> <div style="background-color: #800080; color: white; padding: 2px;">Peak Detect</div> <div style="background-color: #800080; color: white; padding: 2px;"></div> <div style="background-color: #800080; color: white; padding: 2px;">Sampling</div> <div style="background-color: #800080; color: white; padding: 2px;">Equivalent</div> <div style="background-color: #800080; color: white; padding: 2px;">Record</div> | Softkey | Options | Description |
|--|-----------------|-------------|-------------------------|
| | Mode | Normal | Normal acquisition. |
| | | Average | Average acquisition. |
| | | Peak Detect | Peak detect acquisition |
| | Sampling | Equivalent | Equivalent sampling. |
| | | Real Time | Real time sampling. |
| | Record | ---- | Select Record menu |

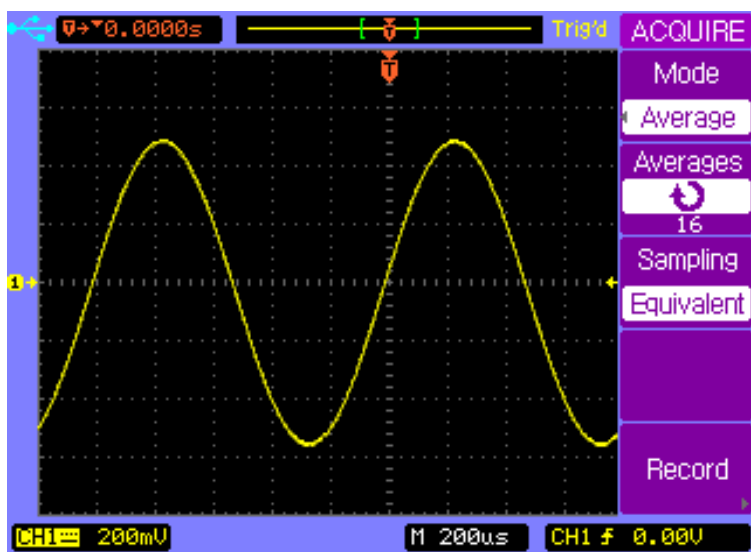
Basic Operation

Connect a sine signal to the CH1 channel, press **ACQUIRE** → **Mode** to select Average mode. Turn the Entry knob to set the number of averages to 16. The following two figures show the difference between Normal acquisition and Average acquisition.



Random noise on the displayed waveform

Basic Operation





16 Averages used to reduce random noise

Basic Operation

Record the Waveform

Press **ACQUIRE** → **Record** to show the **RECORD** menu.




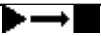

| Softkey | Options | Description |
|------------------|---|---|
| Mode | Record | Record the waveform |
| | Play Back | Play back the record |
| | Save /Recall | Save/Recall from internal or external memory. |
| | OFF | Exit Record function |
| Source | CH1 | Record CH1 channel |
| | CH2 | Record CH2 channel |
| | Pass/Fail Out | Record Pass/Fail output waveform |
| Interval |  | Set the time interval |
| End Frame |  | Maximum record frame |
| Operate | | Record |
| | | Stop |

Basic Operation

Play Back the Record




Press **ACQUIRE** → **Record** to show the **RECORD** menu. Press **Mode** softkey to select Play Back function.



| Softkey | Options | Description |
|----------------------|---|---|
| Mode | Record | Record the waveform |
| | Play Back | Play back the record |
| | Save /Recall | Save/Recall from internal or external memory. |
| | OFF | Exit Record function |
| Operate | | Play |
| | | Stop |
| Play Mode |  | Loop play |
| |  | Single play |
| Current Frame |  | Select a specific frame |
| More 1/2 | ---- | Select menu page 2/2 |

Basic Operation

Press **ACQUIRE** → **Record** to show the **RECORD** menu. Press **Mode** softkey to select Play Back function. Press **More 1/2** softkey to show **RECORD** menu page 2/2.

| RECORD | Softkey | Options | Description |
|--------------------|-------------|---|----------------------------------|
| Interval 10.0ms | Interval |  | Interval between two frames |
| Start Frame 1 | Start Frame |  | Set the start frame to playback. |
| End Frame 1000 | End Frame |  | Set the end frame to playback. |
| Msg Display ON | Msg Display | ON | Record message on |
| | | OFF | Record message off |
| -More- 2/2 | More 2/2 | ---- | Select menu page 1/2 |

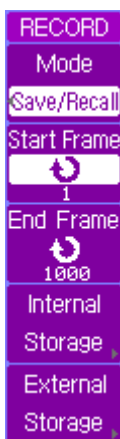
Note: The interval time must be greater than 1ms + signal period + sampling interval time + frame storage time .

Note: Frame length is the waveform storage depth.
Maximum 1000 frames of waveform can be stored.

Basic Operation

Save/Recall the Record



Press **ACQUIRE** → **Record** to show the **RECORD** menu. Press **Mode** softkey to select **Save/Recall** function.



| Softkey | Options | Description |
|-------------------------|--------------|---|
| Mode | Record | Record the waveform |
| | Play back | Play back the record |
| | Save /Recall | Save/Recall from internal or external memory. |
| | OFF | Exit Record function |
| Start Frame | ↺ | Set the start frame to playback. |
| End Frame | ↺ | Set the end frame to playback. |
| Internal Storage | ---- | Save/Recall from internal memory. |
| External Storage | ---- | Save/Recall from external memory. |

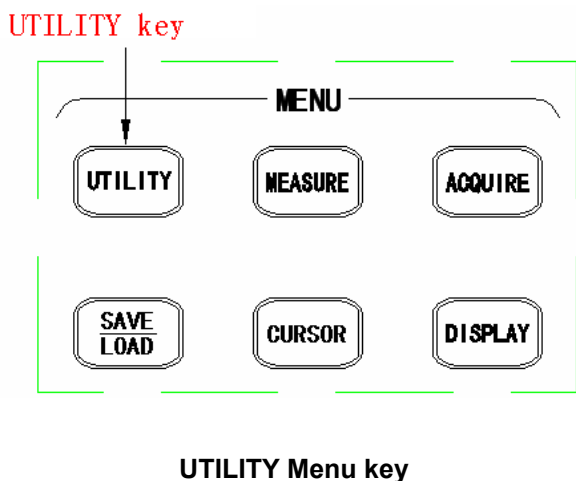
Exit Record Function

Press **Mode** softkey to select **OFF** option and return to the **ACQUIRE** menu.

|  | Softkey | Options | Description |
|---|---|--------------|---|
| | Mode | Record | Record the waveform |
| | | Play back | Play back the record |
| | | Save /Recall | Save/Recall from internal or external memory. |
| | | OFF | Exit Record function |
| |  | ---- | Return to ACQUIRE menu |

UTILITY Menu

Press the **UTILITY** menu key to show the **UTILITY** menu.



Basic Operation

Press the **UTILITY** key to display the **UTILITY** menu page 1/2.

| | | | |
|----------------|---------------------|----------------|------------------------------|
| UTILITY | Softkey | Options | Description |
| I/O Setup | I/O Setup | ---- | Select I/O SETUP menu |
| Print Setup | Print Setup | ---- | Select PRINT menu |
| System Setup | System Setup | ---- | Select SYETEM menu |
| Language | Language | 简体中文 | Simplified Chinese |
| English | | 繁體中文 | Traditional Chinese |
| -More- | | English | English language |
| 1/2 | | 한국어 | Korean language |
| | | 日本語 | Japanese language |
| | | Русский | Russian language |
| | | Français | French language |
| | | Español | Spanish language |
| | | Polski | Persian language |
| | | Português | Portuguese language |
| | More 1/2 | ---- | Select menu page 2/2 |



Basic Operation

Press the **More 1/2** softkey to display the **UTILITY** menu page 2/2.

| UTILITY | Softkey | Options | Description |
|---------------|------------------|-----------------|---------------------------------------|
| Service | Service | ---- | Select Service menu |
| Pass/Fail | Pass/Fail | ---- | Select PASS/FAIL menu |
| Self-Cal | Self-Cal | RUN/STOP | Start self-calibration |
| Fast-Cal | | AUTO | Exit self-calibration. |
| Fast-Cal | Fast-Cal | ON | Fast calibrate the vertical position. |
| Fast-Cal | | OFF | Close the fast calibration. |
| OFF | More 2/2 | ---- | Select menu page 1/2 |
| -More- 2/2 | | | |

I/O Setup



Press **UTILITY** → **I/O Setup** to display the **I/O SETUP** menu.

| I/O SETUP Type USB DEVICE | Softkey | Options | Description |
|---------------------------------|---|---|---|
| | Type | USB Device | Select USB IF |
| | | RS232C | Select RS232C IF |
| | Baud Rate |  | Available baud rate: 2400, 4800, 9600, 19200, 38400 |
| |  | ---- | Return to the UTILITY menu |

Basic Operation

Print Setup

Press **UTILITY** → **Print Setup** to display the **PRINT** menu.

| | | | |
|---|---|----------------|----------------------------|
| PRINT | Softkey | Options | Description |
| Print to File | Print to | File | Print to file |
| File Type BMP(24Bit) | File Type | BMP(8Bit) | 8-Bit BMP file format |
| | | BMP(24Bit) | 24 Bit BMP file format |
| Screen Normal | | CSV | CSV file format |
| | Screen | Normal | Normal BMP picture |
| | | Inverted | Inverted color BMP picture |
|  |  | ---- | Return to the UTILITY menu |







Connect an USB mass storage device to the USB host connector on the front panel.

Press **File Type** softkey to select the file format you want.

Press the **PRINT** key to save the file to the USB mass storage device.



System Setup

Press **UTILITY** → **System Setup** to display the **SYSTEM** menu page 1/2.

| | | | |
|---|--------------------|---|-----------------------|
| SYSTEM | Softkey | Options | Description |
| Key Sound | Key Sound |  | Key press sound on |
|  | |  | Key press sound off |
| Alarm Sound | Alarm Sound |  | Alarm sound on |
|  | |  | Alarm sound off |
| Counter | Counter | ON | Frequency counter on |
| OFF | | OFF | Frequency counter off |
| -More- 1/2 | More 2/2 | ---- | Select menu page 1/2 |

Basic Operation

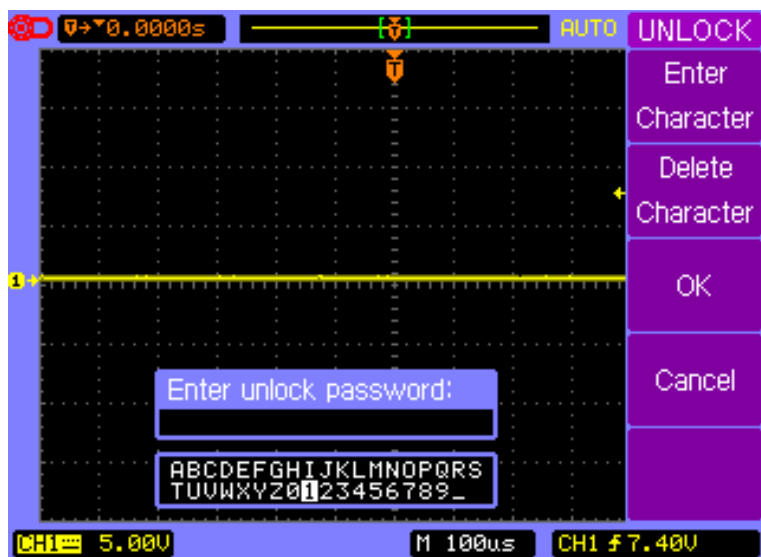
Press the **More 1/2** softkey to display the **SYSTEM** menu page 2/2.

| | | | |
|---|---|----------------|--|
| SYSTEM | Softkey | Options | Description |
| Key Lock | Key Lock | ON | Key Lock function on |
| OFF | | OFF | Key Lock function off, a password is required when Password is ON. |
| Password | Password | ON | Password protection on |
| ON | | OFF | Password protection off, a password is required when Password is ON. |
| Change Password | Change Password | | The old password is required to change the password. |
|  |  | ---- | Return to the UTILITY menu |
| -More- 2/2 | More 2/2 | ---- | Select menu page 1/2 |

Note: The default password is “111111”

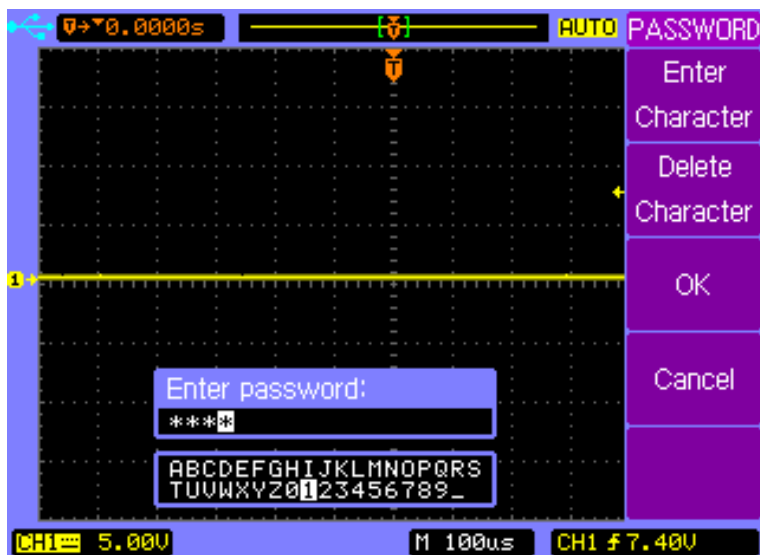
Basic Operation

Press **UTILITY** → **System Setup** → **Key Lock** to lock the front panel operation, all the keys and controls are disabled except **MENU ON/OFF** key and the five softkeys. When front panel is locked a red lock icon is displayed at the top-left corner of the screen. Correct password is required to unlock the front panel operation when Password is ON as shown below. The default password is “111111”.



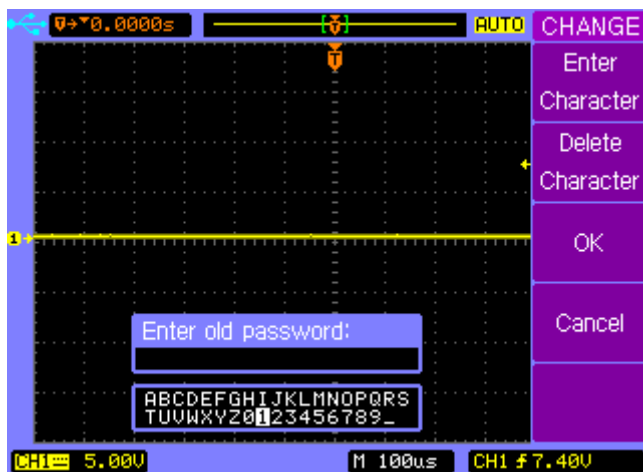
Basic Operation

Press **Password** softkey from the **SYSTEM** menu 2/2 to turn off the Password protection function, correct password is required as shown below.





Basic Operation

Press **Change Password** softkey from the **SYSTEM** menu page 2/2 to display the **CHANGE** menu. The old password is required before entering the new password and confirming the new password as shown below.



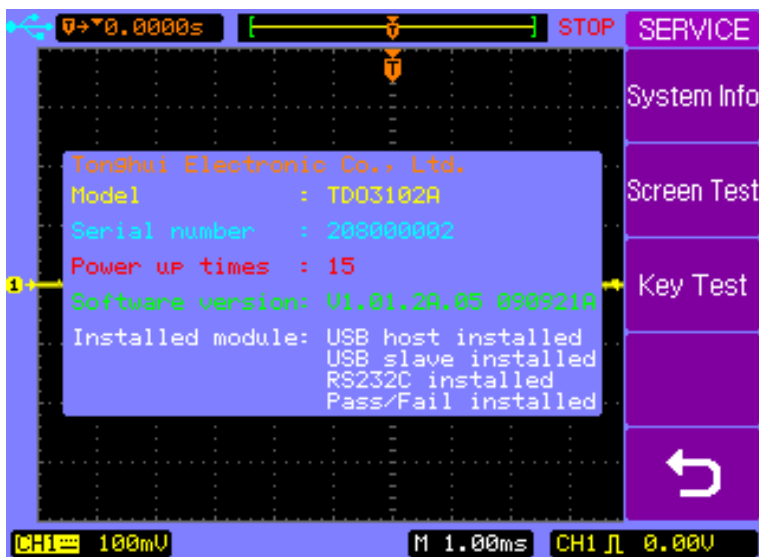
Service

Press **UTILITY** → **Service** to display the **Service** menu.

| | | | |
|---|---|----------------|--|
| SERVICE | Softkey | Options | Description |
| System Info | System Information | ---- | Display system information: Model, Serial number, Software version, Installed modules. |
| Screen Test | Screen Test | ---- | Test the LCD screen |
| Key Test | Key Test | ---- | Check the key and control operation. |
|  |  | ---- | Return to the UTILITY menu |

Basic Operation

Press **UTILITY** → **Service** to display the **Service** menu, and then press the **System Info** softkey to display the system informations, such as Model, Serial number, Power up times, Software version and a list of installed modules.



System Information

Basic Operation

Pass/Fail




The oscilloscope first measures the input source signal and compares it with Pass/Fail regulations and then outputs the Pass/Fail result.

Press **UTILITY** → **Pass/Fail** to display the **PASS/FAIL** menu 1/2.

| PASS/FAIL | Softkey | Options | Description |
|---------------|--------------------|---------|------------------------|
| Enable Test | Enable Test | ON | Pass/Fail function on |
| OFF | | OFF | Pass/Fail function off |
| Source | Source | CH1 | Source signal CH1 |
| CH1 | | CH2 | Source signal CH2 |
| Operate | Operate | | Start Pass/Fail test |
| | | | Stop Pass/Fail test |
| Setup Mask | Setup Mask | ---- | Set up the regulations |
| -More- 1/2 | More 1/2 | ---- | Display the menu 2/2 |

Basic Operation

Press **More 1/2** to display the **PASS/FAIL** menu 2/2.

| PASS/FAIL Msg Display ON Output Fail Stop on Output OFF ↶ -More- 2/2 | Softkey | Options | Description |
|---|---|---|------------------------------------|
| | Msg Display | ON | Pass/Fail count message on |
| | | OFF | Pass/Fail count message off |
| | Output | PASS | Output on Pass waveforms |
| | | PASS+  | Output and alarm on Pass waveforms |
| | | FAIL | Output on Fail waveforms |
| | | FAIL+  | Output and alarm on Fail waveforms |
| | Stop on Output | ON | Stop sampling on output |
| | | OFF | Continue sampling on output |
| |  | ---- | Return to the UTILITY menu |
| | More 2/2 | ---- | Display the menu page 1/2 |

Note: *Pass/Fail function is not available when X-Y mode is selected.*



Basic Operation

Press **UTILITY** → **Pass/Fail** → **Setup Mask** to display the **MASK** menu 1/2.

| MASK | Softkey | Options | Description |
|-------------------|-------------|---------|--------------------------------------|
| X Mask 0.40div | X Mask | ↺ | Set horizontal tolerance |
| Y Mask 0.40div | Y Mask | ↻ | Set vertical tolerance. |
| Create Mask | Create Mask | ---- | Create the PASS/FAIL tolerance mask. |
| ↩ | ↩ | ---- | Return to the PASS/FAIL menu |
| -More- 1/2 | More 1/2 | ---- | Display the menu 2/2 |

Basic Operation

Press **More 1/2** to display the **MASK** menu 2/2.

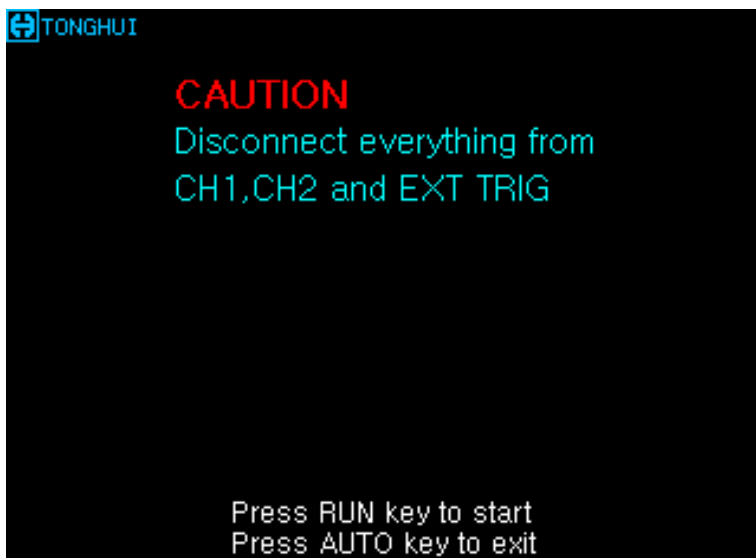
| | Softkey | Options | Description |
|---|---|---------|---|
| MASK | | | |
| Internal Storage | Internal Storage | ---- | Store the PASS/FAIL tolerance mask to internal memory. |
| External Storage | External Storage | ---- | Store the PASS/FAIL tolerance mask to external USB mass storage device. |
|  |  | ---- | Return to the PASS/FAIL menu |
| -More- 2/2 | More 2/2 | ---- | Display the menu page 1/2 |

Self-Calibration

If you want to maximize the measurement accuracy, you can perform the self-calibration.

Self-calibration uses the internally generated signals to optimize circuits that affect channel scale, offset and trigger parameters. Disconnect all inputs and allow the oscilloscope to warm up at least 30 minutes before performing this self-calibration.

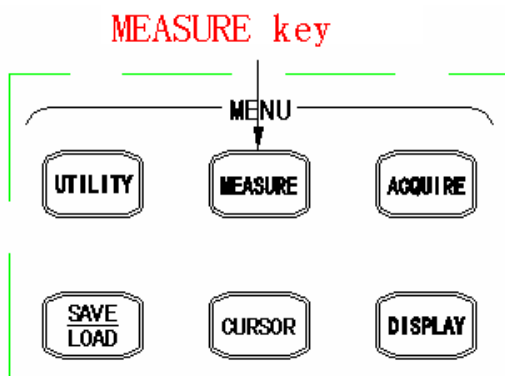
Press **UTILITY** → **Self-Cal** to display the self-calibration page. Press **AUTO** key to exit the Self-Calibration, press **RUN** key to start the self-calibration.



Self Calibration

Note: Warm up the oscilloscope at least 30 minutes before performing self-calibration.

MEASURE Menu



MEASURE Menu key

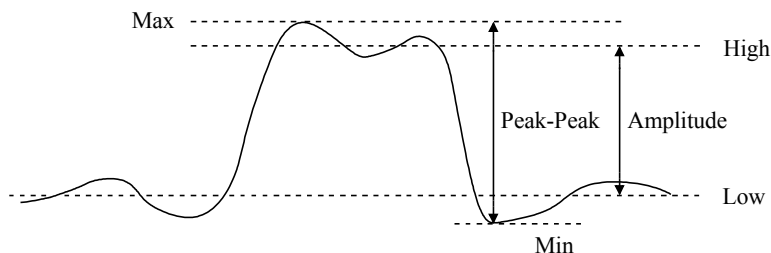
Basic Operation

Press **MEASURE** menu key to display the **MEASURE** menu.

| MEASURE | Softkey | Options | Description |
|-------------|--------------------|---------|---|
| Source | Source | CH1 | Measure CH1 |
| CH1 | | CH2 | Measure CH2 |
| Voltage | Voltage | ---- | Select the Voltage measurement menu. |
| Time | Time | ---- | Select the Time measurement menu |
| Clear | Clear | ---- | Turn off the current measurement readouts |
| Measure All | Measure All | ON | Display all measurements |
| OFF | | OFF | Close all measurements |

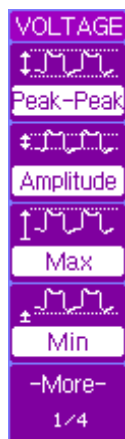
Basic Operation

Voltage Measurements



Voltage parameter definitions

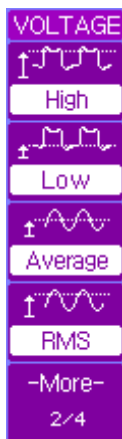
Press **MEASURE** → **Voltage** to display the **VOLTAGE** menu page 1/4.



| Softkey | Options | Description |
|------------------|---------|---|
| Peak-Peak | ---- | The Peak-Peak value is the difference between maximum and minimum values. |
| Amplitude | ---- | The Amplitude value is the difference between its High and Low values. |
| Max | ---- | Max is the highest value in the waveform display. |
| Min | ---- | Min is the lowest value in the waveform display |
| More 1/4 | ---- | Display menu page 2/4 |

Basic Operation

Press **More 1/4** softkey to display the **VOLTAGE** menu page 2/4.



| Softkey | Options | Description |
|-----------------|---------|--|
| High | ---- | High value is the mode (most common value) of the upper part of the waveform. |
| Low | ---- | Low value is the mode (most common value) of the lower part of the waveform. |
| Average | ---- | Average value is the sum of the samples divided by the number of samples over the entire waveform. |
| RMS | ---- | RMS value is the true Root Mean Square voltage over the entire waveform. |
| More 2/4 | ---- | Display menu page 3/4 |

Basic Operation

Press **More 2/4** softkey to display the **VOLTAGE** menu page 3/4.

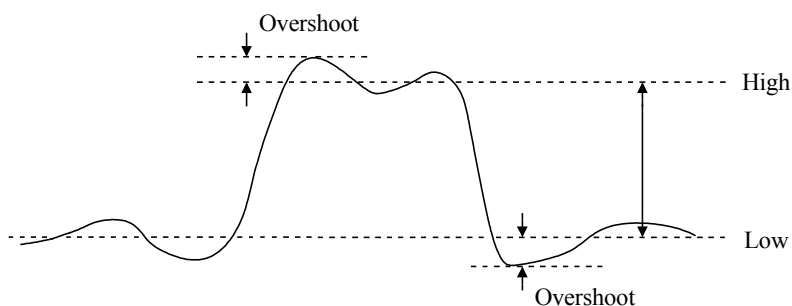


| Softkey | Options | Description |
|------------------|---------|--|
| Cycle Avg | ---- | Cycle Avg value is the sum of the samples divided by the number of samples over one period. |
| Cycle RMS | ---- | Cycle RMS value is the true Root Mean Square voltage over one period. |
| Overshoot | ---- | Overshoot value is distortion that follows a major edge transition expressed as a percentage of amplitude. |
| Preshoot | ---- | Preshoot value is distortion that precedes a major edge transition expressed as a percentage of amplitude. |
| More 3/4 | ---- | Display menu page 4/4 |

Basic Operation

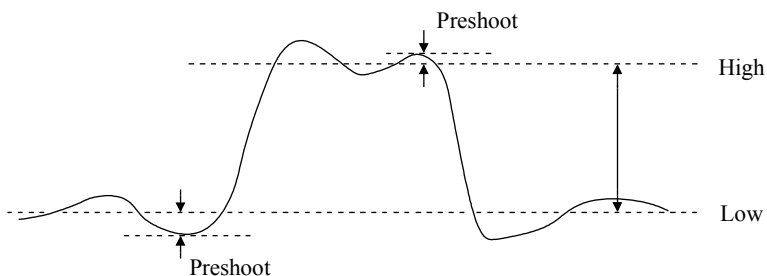
$$\text{Rising Edge Overshoot} = \frac{\text{Max} - \text{High}}{\text{Amplitude}} \times 100$$

$$\text{Falling Edge Overshoot} = \frac{\text{Low} - \text{Min}}{\text{Amplitude}} \times 100$$



$$\text{Rising Edge Preshoot} = \frac{\text{Low} - \text{Min}}{\text{Amplitude}} \times 100$$


$$\text{Falling Edge Preshoot} = \frac{\text{Max} - \text{High}}{\text{Amplitude}} \times 100$$



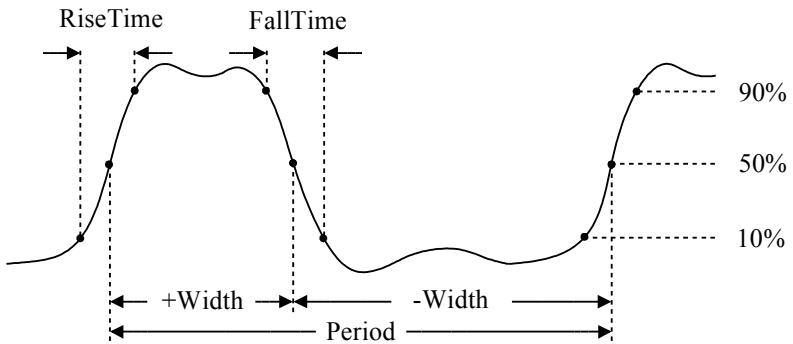
Basic Operation

Press **More 3/4** softkey to display the **VOLTAGE** menu page 4/4.



| Softkey | Options | Description |
|---|---------|-----------------------------------|
|  | ---- | Return to the MEASURE menu |
| More 4/4 | ---- | Display menu page 1/4 |

Time Measurements



Time parameter definitions

Basic Operation

Press **MEASURE** → **Time** to display the **TIME** menu page 1/5.



| Softkey | Options | Description |
|------------------|---------|--|
| Frequency | ---- | Frequency is defined as 1/period of the first cycle. |
| Period | ---- | Period is the time period of the first complete waveform cycle. |
| Rise Time | ---- | Rise Time is the time that the first positive-going edge takes to rise from 10% to 90% of its amplitude. |
| Fall Time | ---- | Fall Time is the time that the first negative-going edge takes to fall from 90% to 10% of its amplitude. |
| More 1/5 | ---- | Display menu page 2/5 |

Basic Operation





Press **More 1/5** softkey to display the **TIME** menu page 2/5.



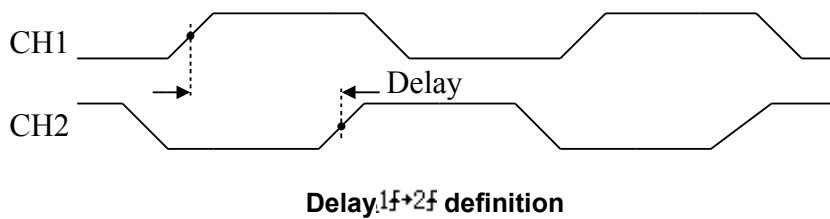
| Softkey | Options | Description |
|-----------------|---------|--|
| +Width | ---- | Positive Width is the time between the 50% amplitude points of the first positive pulse. |
| -Width | ---- | Negative Width is the time between the 50% amplitude points of the first negative pulse. |
| +Duty | ---- | Positive Duty is the ratio of the first positive width to its period, expressed as a percentage. |
| -Duty | ---- | Negative Duty is the ratio of the first negative width to its period, expressed as a percentage. |
| More 2/5 | ---- | Display menu page 3/5 |

Basic Operation

Press **More 2/5** softkey to display the **TIME** menu page 3/5.

| TIME | Softkey | Options | Description |
|--|-------------------|---------|---|
|  Delay1f+2f | Delay1f+2f | ---- | The time between the 50% amplitude points of the first positive-going edge of each channel. |
|  Delay1t+2t | Delay1t+2t | ---- | The time between the 50% amplitude points of the first negative-going edge of each channel. |
|  Delay1f+2t | Delay1f+2t | ---- | The time between the first positive-going edge of CH1 and the first negative-going edge of CH2 at each 50% amplitude point. |
|  Delay1t+2f | Delay1t+2f | ---- | The time between the first negative-going edge of CH1 and the first positive-going edge of CH2 at each 50% amplitude point. |
| -More- 3/5 | More 3/5 | ---- | Display menu page 4/5 |

Basic Operation



Basic Operation

Press **More 3/5** softkey to display the **TIME** menu page 4/5.

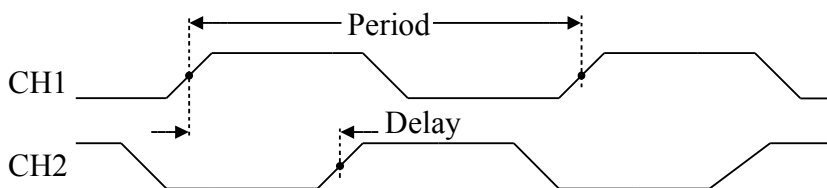


| Softkey | Options | Description |
|------------------|---------|--|
| Phase 1→2 | ---- | Phase 1→2 is the ratio of Delay 1→2 to the period of CH1, expressed in degrees. |
| Phase 2→1 | ---- | Phase 2→1 is the ratio of Delay 2→1 to the period of CH2, expressed in degrees. |
| X at Max | ---- | X at Max is the X axis value (refer to Trigger point) at the first displayed occurrence of the waveform Maximum, starting from the left side of the display. |
| X at Min | ---- | X at Min is the X axis value (refer to Trigger point) at the first displayed occurrence of the waveform Minimum, starting from the left side of the display. |
| More 4/5 | ---- | Display menu page 5/5 |

Basic Operation

$$\text{Phase } 1 \rightarrow 2 = \frac{\text{CH2 50\% Time} - \text{CH1 50\% Time}}{\text{CH1 Period}} \times 360$$


$$\text{Phase } 2 \rightarrow 1 = \frac{\text{CH1 50\% Time} - \text{CH2 50\% Time}}{\text{CH2 Period}} \times 360$$




Phase 1→2 definition

Basic Operation

Press **More 4/5** softkey to display the **TIME** menu page 5/5.

| TIME | Softkey | Options | Description |
|------|---|---------|-----------------------------------|
| |  | ---- | Return to the MEASURE menu |
| | More 5/5 | ---- | Display menu page 1/5 |

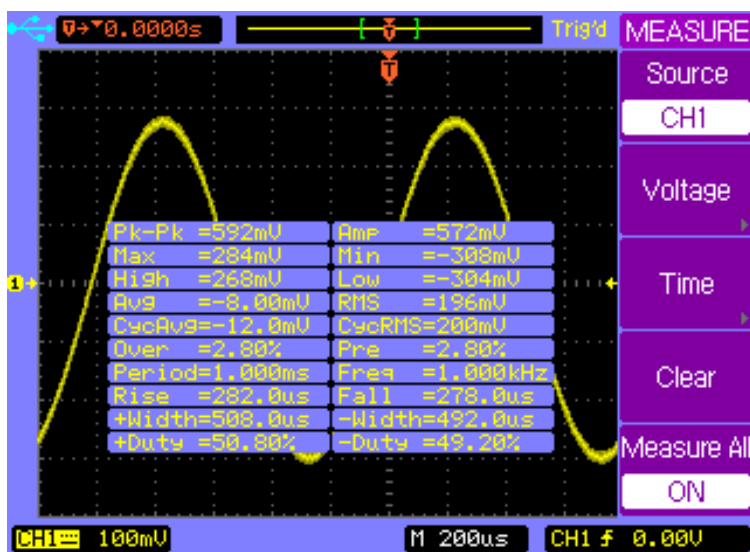


-More-
5/5

Basic Operation

Automatic Measurement Procedure

Press **MEASURE** → **Measure All** to turn on all Auto Measurements. Up to 20 kinds of measurements of current channel are displayed on the center of the screen.



Press **Measure All** again to turn off all Auto Measurements.

Press **MEASURE** → **Voltage** to display the **VOLTAGE** menu or press **MEASURE** → **Time** to display the **TIME** menu.

Press softkey of voltage or time parameters you want to measure.

Basic Operation

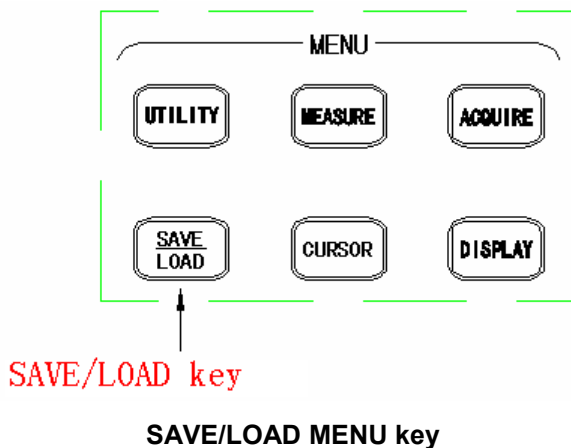
The selected parameter will be displayed on the bottom of the display.

Press **Clear** softkey to clear all displayed measurement parameter.

Note: Up to three parameters can be displayed at the same time on the bottom of the display. Press the parameter softkey to add a new parameter when three parameters are already displayed. The first parameter will be pushed out of the display window and the new parameter will be displayed on the bottom right of the display screen.

Note: “*” will be displayed when a parameter can not be measured correctly.***

SAVE/LOAD Menu







Press **SAVE/LOAD** key to display the **SAVE/LOAD** menu.

| SAVE/LOAD | Softkey | Options | Description |
|------------------|-------------------------|---------|--|
| Internal Storage | Internal Storage | ---- | Display the INTERNAL menu. |
| External Storage | External Storage | ---- | Display the EXTERNAL menu. |
| | Factory | ---- | Set the instrument to the factory default configuration. |
| | | | |
| Factory | | | |





Internal Storage

Press **SAVE/LOAD** → **Internal Storage** → **Storage type** to display the **INTERNAL** menu and select Trace storage type.

| | | | |
|---|---|---|--|
| INTERNAL | Softkey | Options | Description |
| Storage type | Storage | Traces | Trace file format |
| Traces | type | Setups | Setup file format |
|  Trace01 | Tracexx |  | Select a trace file from Trace01 to Trace10. |
| Save | Save | ---- | Save the display to current trace file. |
| Load | Load | ---- | Load the current trace file. |
|  |  | ---- | Return to the SAVE/LOAD menu |



Basic Operation

Press **SAVE/LOAD** → **Internal Storage** → **Storage type** to display the **INTERNAL** menu and select Setups storage type.

|  | Softkey | Options | Description |
|---|---|---|---|
| | Storage type | Traces | Trace file format |
| | | Setups | Setup file format |
| | Setupxx |  | Select a setup file from Setup01 to Setup10. |
| | Save | ---- | Save the current configuration to the current setup file. |
|  | Load | ---- | Load from the current setup file. |
| |  | ---- | Return to the SAVE/LOAD menu |

External Storage



Press **SAVE/LOAD** → **External Storage** to display the **EXTERNAL** menu.

| EXTERNAL | Softkey | Options | Description |
|---|---|---------|---|
| New | New | ---- | Create a new file or folder in the external memory. |
| Rename | Rename | ---- | Rename the current file or folder. |
| Load | Load | ---- | Load the current file. |
| Delete | Delete | ---- | Delete the current file or folder. |
|  |  | ---- | Return to the SAVE/LOAD menu |

Note: *The External Storage menu and operations will not be available unless the external USB mass storage device is installed.*



Basic Operation

Press **SAVE/LOAD** → **External Storage** → **New** to display the **New** menu.

| New | Softkey | Options | Description |
|---|---|---------|-------------------------------------|
| New File | New File | ---- | Display the New File menu. |
| New Folder | New Folder | ---- | Display the New Folder menu. |
| |  | ---- | Return to the EXTERNAL menu |
| | | | |
| | | | |
|  | | | |

Basic Operation

Press **SAVE/LOAD**→**External Storage**→**New**→**New File** to display the **New File** menu.



| | | | |
|---|---|----------------|---|
| New File | Softkey | Options | Description |
| Save as | Save as | Setups | Save as setup files |
| Setups | | Traces | Save as trace files |
| Enter | | Waveforms | Save as waveform files |
| Character | | BMP | Save as BMP files |
| | | CSV | Save as CSV files |
| Delete | Enter | ---- | Enter the selected character and go to the next character position. |
| Character | Character | | |
| | Delete | ---- | Delete the selected character. |
| Save | Character | | |
|  | Save | ---- | Save the new file. |
| |  | ---- | Return to the New menu |

Note: Maximum length of a file name is 8 characters. Press **Enter Character** to select a character position in the file name. Turn the entry knob to select a character. Press **Delete Character** to delete the current selected character. Press **Enter Character** to enter the selected character and go to the next character position.

Press **SAVE/LOAD**→**External Storage**→**New**→**New Folder** to display the **New Folder** menu.



| Softkey | Options | Description |
|---------|---------|-------------|
|---------|---------|-------------|

Basic Operation

| | | | |
|---|---|------|---|
| New Folder | Enter Character | ---- | Enter the selected character and go to the next character position. |
| Enter Character | Delete Character | ---- | Delete the selected character. |
| Delete Character | Save | ---- | Save the new folder. |
| Save |  | ---- | Return to the New menu |
|  | | | |



Basic Operation

Press **SAVE/LOAD**→**External Storage**→**Rename** to display the **Rename** menu.

| Rename | Softkey | Options | Description |
|---|---|---------|---|
| | Enter Character | ---- | Enter the selected character and go to the next character position. |
| Enter Character | Delete Character | ---- | Delete the selected character. |
| Delete Character | OK | ---- | Rename the selected file or folder. |
| OK |  | ---- | Return to the EXTERNAL menu |
|  | | | |

Basic Operation

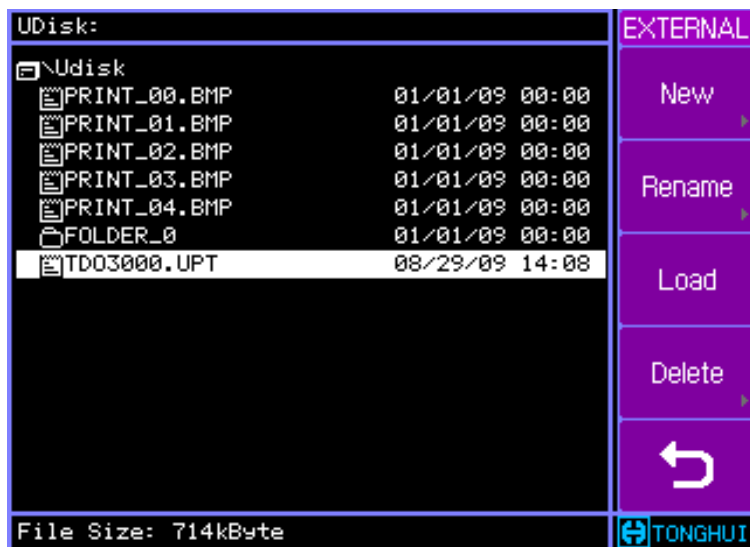
Press **SAVE/LOAD** → **External Storage** → **Delete** to display the **Delete** menu.

| Delete | Softkey | Options | Description |
|---|---|---------|--|
| | OK | ---- | Confirm to delete the selected file or folder. |
| OK | Cancel | ---- | Cancel the delete operation. |
| Cancel |  | ---- | Return to the EXTERNAL menu |
| | | | |
|  | | | |

Software Update

Press **SAVE/LOAD** → **External Storage** to display the **EXTERNAL** menu.

Turn the entry knob to select the correct update file. File DSO-3000.UPT is selected as shown in the following figure.



Press **Load** softkey to start the update operation. A Loading and then an updating progress bar will be displayed and indicate the process of the update operation.

Finally, information “**Restart to complete updating**” will be displayed to remind you to restart the instrument.

Basic Operation

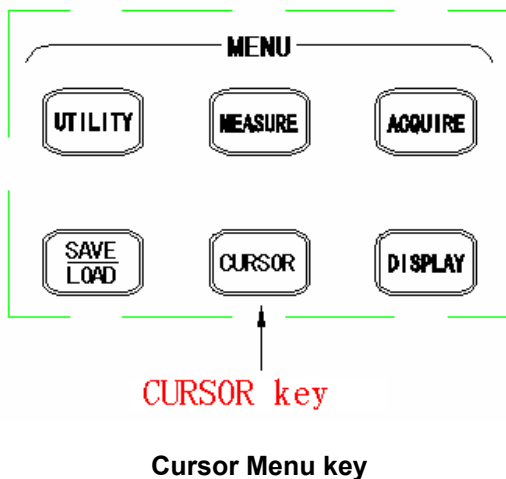
If the software update is failed, repeat the above procedures to update again.

***Note: The default file extension of the update file is ".upt".
Select the correct update file according to the model
of the oscilloscope. Error message "Incompatible file
" will be displayed when the model is not match.***

***Note: The power supply of the oscilloscope can not be
turned off during the updating process. If this
happens, you will have to return the instrument to
factory for service.***

CURSOR Menu

You can measure waveform data using cursors. Cursors are horizontal and vertical markers that indicate X-axis values (usually time) and Y-axis (usually voltage) on a selected waveform source. The position of the cursors can be moved by turning the entry knob.



The oscilloscope provides three kinds of cursor measurement modes: **Manual**, **Auto** and **Track**.

Manual Mode


In the manual mode, you can move the cursors to measure the voltage or time on the select source waveform.

Press **CURSOR**→**Mode** to display the **CURSOR** menu and select the **Manual** mode. Press the **Type** softkey to select **Voltage** measurement.

| CURSOR | Softkey | Options | Description |
|-----------------------------------|---------------|---------|--|
| Mode | Mode | Manual | Manual cursor measurement |
| Manual | | Auto | Auto cursor measurement |
| Source | | Track | Track cursor measurement |
| CH1 | Source | CH1 | Measure CH1 |
| Type | | CH2 | Measure CH2 |
| Voltage | | FFT | Measure FFT |
| Y1 -- 1.00U Y2 -- -1.00U | Type | Voltage | Measure voltage value |
| ΔY 2.00U | | Time | Measure time value |
| Y1-- Y2-- | | | Press this softkey to active Y1, Y2, or both Y1 and Y2 cursors for adjustment. Current voltage values for Y1 and Y2 are displayed in the softkey or on the top right corner when menu is off. |
| ΔY | | ---- | The difference value between Y1 and Y2 cursors. |

Basic Operation








Press **CURSOR**→**Mode** to display the **CURSOR** menu and select the **Manual** mode. Press the **Type** softkey to select **Time** measurement.

| CURSOR | Softkey | Options | Description |
|--------------------------|--|---|---|
| Mode | Mode | Manual | Manual cursor measurement |
| Manual | | Auto | Auto cursor measurement |
| Source | | Track | Track cursor measurement |
| CH1 | Source | CH1 | Measure CH1 |
| Type | | CH2 | Measure CH2 |
| Time | | FFT | Measure FFT |
| X1-- -6.000us | Type | Voltage | Measure voltage value |
| X2-- 6.000us | | Time | Measure time value |
| ΔX 12.00us | X1-- X2-- |  | Press this softkey to select X1, X2, or both X1 and X2 cursors for adjustment. Current time values for X1 and X2 are displayed in the softkey or on the top right corner when menu is off. |
| $1/\Delta X$ 83.33kHz | ΔX $1/\Delta X$ | ---- | ΔX is the time difference value between X1 and X2 cursors. $1/\Delta X$ is the frequency between X1 and X2 |

TRACK Mode Two cross hair cursors are displayed on the screen in the track mode. The cross hair cursors track the waveform automatically. You can move the cross hair cursors horizontally by turning the entry knob. The X,Y values of each cross hair cursor are displayed in the softkey area, or on the top right corner when menu is off.

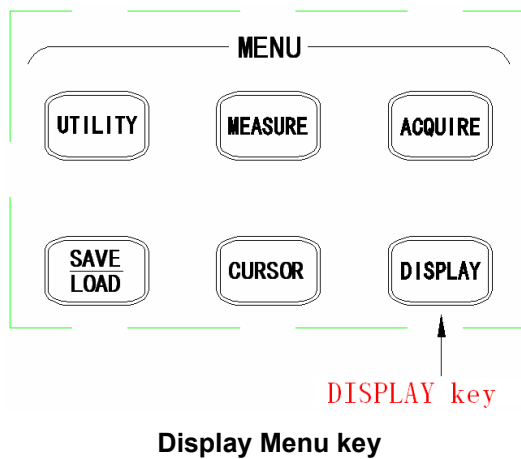
Basic Operation

Press **CURSOR**→**Mode** to display the **CURSOR** menu and select the **Track** mode.

| CURSOR | Softkey | Options | Description |
|---|--|---|--|
| Mode | Mode | Manual | Manual cursor measurement |
| Track | | Auto | Auto cursor measurement |
| Cursor A | | Track | Track cursor measurement |
| CH1 | Cursor A | CH1 | Track CH1 with Cursor A |
| Cursor B | | CH2 | Track CH2 with Cursor A |
| None | | None | Turn off Cursor A |
| | Cursor B | CH1 | Track CH1 with Cursor B |
| | | CH2 | Track CH2 with Cursor B |
| | | None | Turn off Cursor B |
|  |  Ax--  Ay-- |  | Press this softkey to select Cursor A for adjustment. Current X, Y axis values for tacking point of Cursor A are displayed in the softkey or on the top right corner when menu is off. |
| |  Bx--  By-- |  | Press this softkey to select Cursor B for adjustment. Current X, Y axis values for tacking point of Cursor B are displayed in the softkey or on the top right corner when menu is off. |



AUTO Mode The Auto mode cursors are displayed only when auto measurement function is enabled. The oscilloscope displays the auto cursors corresponding to the latest auto measurement parameter. No Auto cursors will be displayed when no auto measurement parameter is selected.

DISPLAY Menu



Basic Operation

Press **DISPLAY** menu key to display the **DISPLAY** menu page 1/2.

| DISPLAY | Softkey | Options | Description |
|--|--------------------------|---|---|
| Type | Type | Vector | Vector mode fills the space between adjacent sample points in the waveform. |
| Vector | | Dots | Dot mode only displays the sample points |
| Persist | Persist | ON | The scope updates the waveform without erasing the previous sample points. |
| OFF | | OFF | Turn off the persistence function |
| Clear | Clear Persistence | ---- | Press the softkey to erase the previous sample points as well as the loaded trace waveform. |
| Persistence | | | |
| Intensity | Intensity |  | Adjust the display intensity of waveforms. |
|  50% | More 1/2 | ---- | Display menu page 2/2. |
| -More- 1/2 | | | |

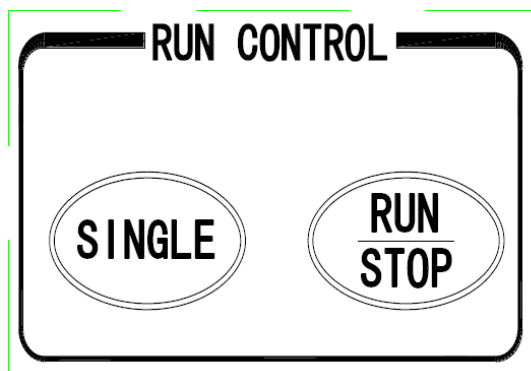
Basic Operation

Press **More 1/2** softkey to display the **DISPLAY** menu page 2/2.



| Softkey | Options | Description |
|---------------------|---------|-------------------------------------|
| Grid | | Display both grids and axes. |
| | | Turn off the axes. |
| | | Turn off the grids. |
| | | Turn off both grids and axes. |
| Brightness | | Adjust the brightness of the grids. |
| Color Setup | ---- | Select Color scheme |
| Menu Display | | Adjust the menu hold on time |
| More 2/2 | ---- | Display menu page 1/2. |

RUN Controls



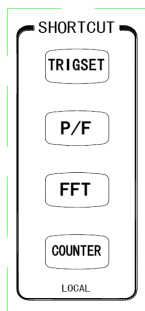
Run controls

Press the **SINGLE** key to execute a single-shot acquisition. The key will illuminate in yellow until the oscilloscope is triggered.

Press the **RUN/STOP** key to make the oscilloscope start looking for a trigger. The **RUN/STOP** key will illuminate in green. When the trigger mode is set to Normal mode, the display will not update until a trigger is found. If the trigger mode is set to Auto mode, the oscilloscope looks for a trigger, and if no trigger is found, it will be triggered automatically and the waveform of input signals will be showed immediately.

Press the **RUN/STOP** key again to stop acquiring data and the **RUN/STOP** key will illuminate in red. Now you can pan across and zoom in on the acquired waveform.

Short-Cut Controls



These four short-cut keys provide alternate quick accesses to some most frequently used functions or menus.

Press **TRIGSET** short-cut key to display the trigger **SETUP** menu directly.

Press **P/F** short-cut key to display the **PASS/FAIL** menu directly.

Press **FFT** short-cut key to display the **FFT** menu directly.

Press **COUNTER** short-cut key to turn on or off the hardware frequency counter function when the oscilloscope is not in remote status. Otherwise when the oscilloscope is in the remote status, press this same key to resume the front panel operation.

3.Application Examples

This section presents 7 typical application examples. These simplified examples highlight the features of the oscilloscope and give you ideas of how to solve your own test problems.

Make Simple Measurements

You need to measure the amplitude and frequency of an unknown signal on CH1.

Perform following steps to quickly display the signal.

- Connect the channel 1 probe to the unknown signal.
- Press the **AUTO** key.

The oscilloscope automatically sets vertical, horizontal, and trigger controls. You can adjust any of these controls manually if you need to optimize the display of the waveform.

When you are using both CH1 and CH2 channels, the Autoset function sets the vertical controls for each channel and uses the CH1 channel to set the horizontal and trigger controls.

The oscilloscope can take automatic measurements of the displayed signals. Perform following steps to measure signal

Application Examples


amplitude and frequency.

- Press the **MEASURE** key to display the **MEASURE** menu.
- Press the **Voltage** softkey to display the **VOLTAGE** menu.
- Press the **Amplitude** softkey to measure the Amplitude. The amplitude value will be displayed at the bottom of the screen.
- Press **MEASURE** key again to display the **MEASURE** menu.
- Press **Time** softkey to display the **TIME** menu.
- Press the **Frequency** softkey to measure the frequency. The frequency value will be displayed at the bottom of the screen to the right of the voltage value.

Application Examples

Capture a Single-Shot Signal

Digital Storage Oscilloscope can easily be used to capture the single-shot or unrepeatable signal. Perform following steps to capture a single-shot signal.

- Connect the channel 1 probe to the unknown signal.
- Press the trigger **MENU** key to display the **TRIGGER** menu.
- Press the **Source** softkey to select CH1.
- Press the **Mode** softkey to select the Auto trigger mode.
- Adjust the vertical and horizontal controls to observe the the signal roughly. And find out the right Trigger Type and Trigger mode.
- Press the **Type** softkey from the **TRIGGER** menu page to select Pulse trigger type.
- Press **More 1/2** sofkey to display the **TRIGGER** menu page 2/2.
- Press **Mode** softkey to select Normal Trigger mode.
- Press **More 2/2** sofkey to display the **TRIGGER** menu page 1/2.
- Press **Pulse Mode** softkey to select  (positive less than).
- Rotate the entry knob (↻) to set up the pulse width.
- Press the **SINGLE** key to start the acquisition system and

Application Examples

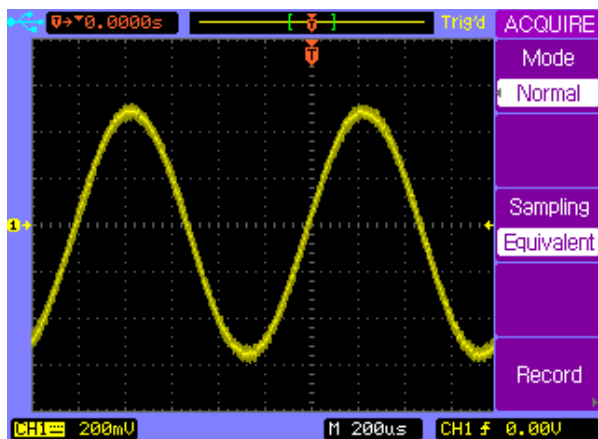
search for the trigger condition. The **SINGLE** key is illuminated in yellow.

- When trigger condition is met, the captured waveform is displayed, the **SINGLE** key is extinguished and the **RUN/STOP** key is illuminated in red.

Application Examples

Reduce the Random Noise on a Signal

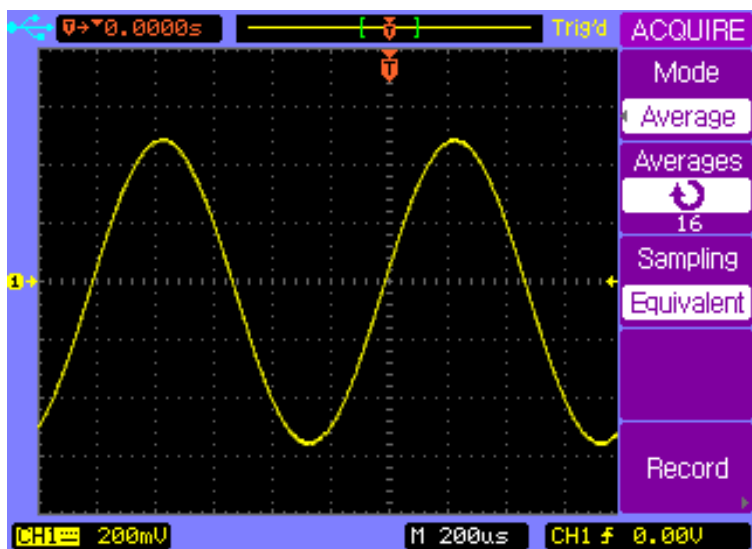
If the test signal is noisy, you can set up the oscilloscope to reduce the noise on the displayed waveform. First, you stabilize the displayed waveform by removing the noise from the trigger path. Second, you reduce the noise on the displayed waveform.



- Connect a signal to the oscilloscope. Press **AUTO** key to display the signal quickly.
- Press the Trigger **MENU** key to display the **TRIGGER** menu.
- Press **Type** softkey to select **Edge** trigger type.

Application Examples

- Press **Trigger Setup** softkey to display the trigger **SETUP** menu
- Press **Coupling** softkey to select **HF Reject** or **LF Reject** coupling mode to reduce the noise from the trigger channel.
- Press the **ACQUIRE** key to display the **ACQUIRE** menu.
- Press the **Mode** softkey to select **Average** mode.
- Rotate the entry knob (↻) to set the number of averages that best eliminates the noise from the displayed waveform.




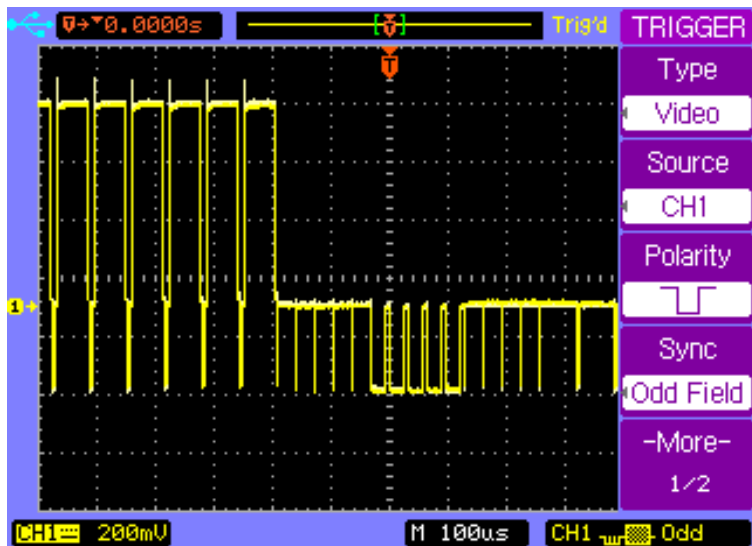
Application Examples

Trigger on a Video Signal

Video trigger can be used to capture the standard video signals. The trigger circuit detects the vertical and horizontal interval of the waveform and produces triggers based on the Video trigger setting you have selected.

Trigger on Odd or Even Fields of the Video Signal

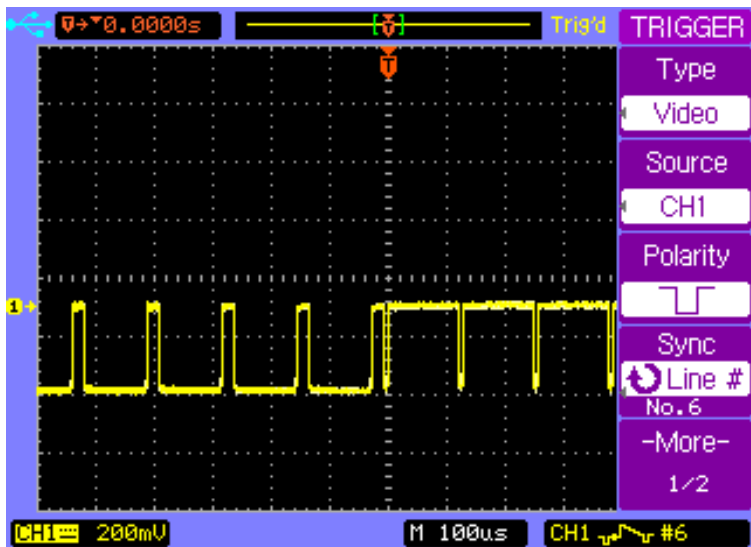
- Press the Trigger **MENU** key to display the **TRIGGER** menu.
- Press the **Type** softkey to select the **Video** trigger mode.
- Press **Source** softkey to select **CH1**.
- Press **Polarity** softkey to select negative polarity .
- Press **Sync** softkey to select **Odd Field** or **Even Field**.



Application Examples

Trigger on a Specific Line or All Lines of the Video Signal

- Press the Trigger **MENU** key to display the **TRIGGER** menu.
- Press the **Type** softkey to select the **Video** trigger mode.
- Press **Source** softkey to select **CH1**.
- Press **Polarity** softkey to select negative polarity $\overline{\square}$.
- Press **Sync** softkey to select **Line #** or **All Lines**.



Application Examples

PASS/FAIL Measurement

The oscilloscope measures and compares the input signal with predefined Pass/Fail thresholds. If the input signal is within the thresholds, PASS signal will be outputted. If the input signal exceeds the thresholds, FAIL signal will be outputted.

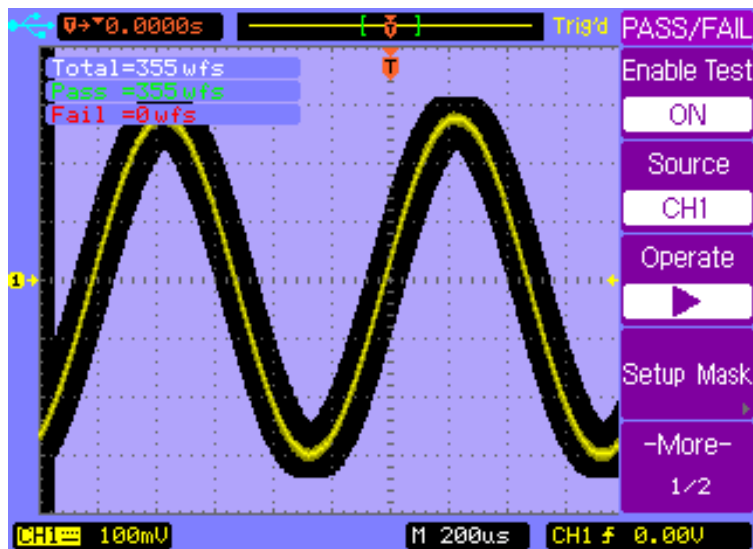
Perform following steps to make a PASS/FAIL measurement.

- Press **UTILITY** key to display the **UTILITY** menu page 1/2.
- Press **More 1/2** softkey to display the **UTILITY** menu page 2/2/
- Press **Pass/Fail** softkey to display the **PASS/FAIL** menu.
- Press **Enable Test** softkey to turn on the **PASS/FAIL** measurement.
- Press **Setup Mask** softkey to display the **MASK** menu.
- Press **X Mask** softkey and then rotate the entry knob to setup the horizontal threshold.
- Press **Y Mask** softkey and then rotate the entry knob to setup the vertical threshold.
- Press **Creat Mask** softkey to update the thresholds.
- Press **↶** softkey to return to the **PASS/FAIL** menu.
- Press **More 1/2** softkey to display the **PASS/FAIL** menu page 2/2.
- Press **Msg Display** softkey to display the Pass/Fail measurement results on the top left corner of the screen.
- Press the **Output** softkey to set how to output the

Application Examples

measurement results.

- Press **More 2/2** to display the **PASS/FAIL** menu page 1/2.
- Press the **Operate** softkey to start PASS/FAIL measurement.



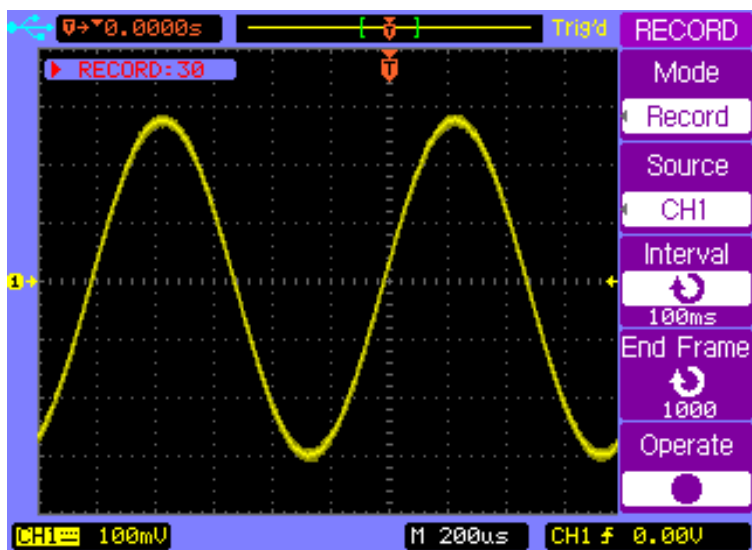
Application Examples

Waveform Recorder

Waveform recorder lets you record waveforms, playback waveforms and save the waveforms.



Perform the following steps to record waveforms.

- Press the **ACQUIRE** key to display the **ACQUIRE** menu.
- Press the **RECORD** softkey to display the **RECORD** menu.
- Press the **Mode** softkey to select **Record** mode.
- Press the **Source** softkey to select the source channel **CH1**.
- Press the **Operate** key to start recording, total recorded frame count is displayed on the top left screen. Press the **Operate** key again to stop recording.

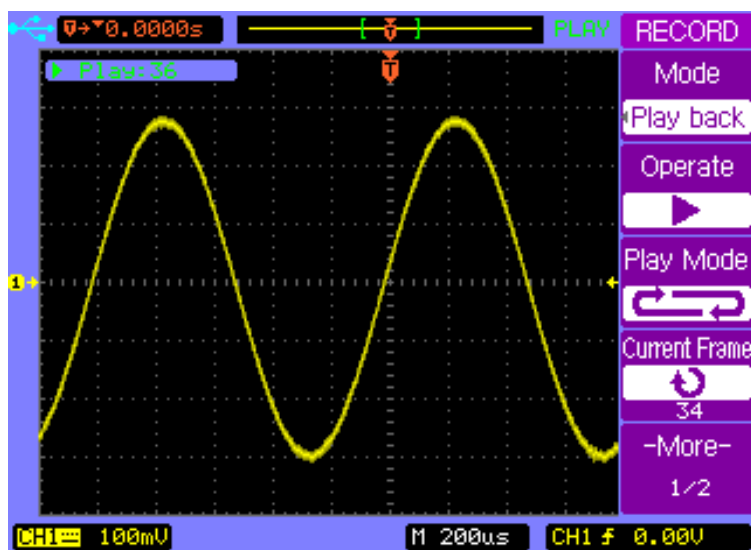


Application Examples

Perform the following steps to playback the waveforms.

- Press the **ACQUIRE** key to display the **ACQUIRE** menu.
- Press the **RECORD** softkey to display the **RECORD** menu.
- Press the **Mode** softkey to select **Play back** mode.
- Press **Play Mode** softkey to select  or  mode.
- Press the **More 1/2** softkey to display the **RECORD** menu page 2/2.
- Press **Start Frame** softkey and turn the entry knob to set the start frame.
- Press **End Frame** softkey and turn the entry knob to set the end frame.
- Press **Interval** softkey and turn the entry knob to set the interval time.
- Press the **More 2/2** softkey to display the **RECORD** menu page 1/2.
- Press **Operate** softkey to playback the waveform.

Application Examples



Application Examples

Perform the following steps to save the waveform recorded.

- Press the **ACQUIRE** key to display the **ACQUIRE** menu.
- Press the **RECORD** softkey to display the **RECORD** menu page 1/2.
- Press the **Mode** softkey to select **Save/Recall** mode.
- Press **Start Frame** softkey and turn the entry knob to set the start frame.
- Press **End Frame** softkey and turn the entry knob to set the end frame.
- Press the **Internal Storage** softkey to Save or Load the recorded waveform from the internal memory.

Application Examples

Cursor Measurements

You can use the cursors to quickly make time and voltage measurements on a waveform. You can use the cursors to measure the amplitude and frequency of a FFT waveform. You can also use the cursors to measure the phase difference between two signals with the same frequency when X-Y horizontal mode is selected.

Measure the time and voltage on normal waveform

Perform the following steps to take time and frequency measurements.

- Press the **CURSOR** key to display the **CURSOR** menu.
- Press **Mode** softkey to select the **Manual** mode.
- Press **Type** softkey to select the **Time** type.
- Press **X1--/X2--** softkey or press the entry knob to select X1 cursor.
- Rotate the entry knob to move the X1 cursor.
- Press **X1--/X2--** softkey or press the entry knob to select X2 cursor.
- Rotate the entry knob to move the X2 cursor.
- ΔX and $1/\Delta X$ are displayed in the softkey area. ΔX is the time difference between X1 and X2; $1/\Delta X$ is the frequency between X1 and X2.

Perform the following steps to take voltage measurement.

Application Examples

- Press the **CURSOR** key to display the **CURSOR** menu.
- Press **Mode** softkey to select the **Manual** mode.
- Press **Type** softkey to select the **Voltage** type.
- Press **Y1--/Y2—** softkey or press the entry knob to select Y1 cursor.
- Rotate the entry knob to move the Y1 cursor.
- Press **Y1--/Y2—** softkey or press the entry knob to select Y2 cursor.
- Rotate the entry knob to move the Y2 cursor.
- ΔY displayed in the softkey area is the voltage difference between Y1 and Y2.

Application Examples

Measure the frequency and amplitude on FFT waveform

Perform the following steps to take frequency measurement.

- Press the **MATH** key to display the **Math** menu.
- Press the **Operate** softkey to select **FFT** and display the **FFT** menu.
- Press the **CURSOR** key to display the **CURSOR** menu.
- Press **Mode** softkey to select the **Manual** mode.
- Press **Source** softkey to select **FFT**.
- Press **Type** softkey to select the **Time** type.
- Press **↶X1--/↶X2—** softkey or press the entry knob to select X1 cursor.
- Rotate the entry knob **↶** to move the X1 cursor.
- Press **↶X1--/↶X2—** softkey or press the entry knob to select X2 cursor.
- Rotate the entry knob **↶** to move the X2 cursor.
- ΔX displayed in the softkey area is the frequency difference between X1 and X2. $1/\Delta X$ is the time difference between X1 and X2.

Perform the following steps to take voltage measurement.

- Press the **MATH** key to display the **Math** menu.
- Press the **Operate** softkey to select **FFT** and display the **FFT** menu.
- Press the **CURSOR** key to display the **CURSOR** menu.
- Press **Mode** softkey to select the **Manual** mode.

Application Examples

- Press **Source** softkey to select **FFT**.
- Press **Type** softkey to select the **Voltage** type.
- Press **Y1--/Y2—** softkey or press the entry knob to select Y1 cursor.
- Rotate the entry knob to move the Y1 cursor.
- Press **Y1--/Y2—** softkey or press the entry knob to select Y2 cursor.
- Rotate the entry knob to move the Y2 cursor.
- ΔY displayed in the softkey area is the voltage difference between Y1 and Y2.

Application Examples

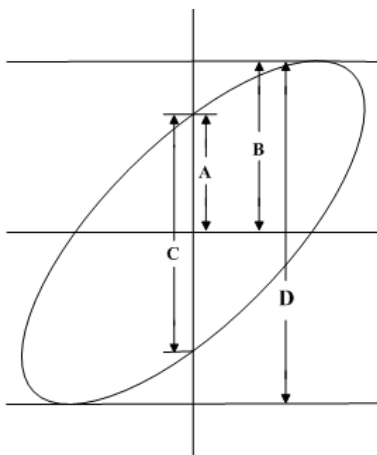
Measure the Phase Difference Between Two Signals of the Same Frequency under X-Y Display Mode.

- Connect a sine wave signal to CH1 and a sine wave signal of the same frequency but out of phase to CH2.
- Press horizontal **MENU** key to display the **Horizontal** menu.
- Press **X-Y** softkey to select **X-Y** display mode
- Center the signal on the display with the vertical control knob of each channel.
- Use the vertical scale control knob of each channel to expand the signal for convenient view.
- Press the **CURSOR** key to display the **CURSOR** menu.
- Press **Mode** softkey to select the **Manual** mode.
- Press **Source** softkey to select **CH2**.
- Press **Type** softkey to select the **Voltage** type.
- Press **Y1--/Y2--** softkey or press the entry knob to select Y1 cursor.
- Rotate the entry knob to move the Y1 cursor to the top of the signal.
- Press **Y1--/Y2--** softkey or press the entry knob to select Y2 cursor.
- Rotate the entry knob to move the Y2 cursor to the bottom of the signal.
- ΔY displayed in the softkey area is the voltage difference D (or 2B) between Y1 and Y2.

Application Examples

- Press **Y1--/Y2** softkey or press the entry knob to select Y1 cursor.
- Rotate the entry knob to move the Y1 cursor to the upper intersection of the signal and Y axis.
- Press **Y1--/Y2** softkey or press the entry knob to select Y2 cursor.
- Rotate the entry knob to move the Y2 cursor to the lower intersection of the signal and Y axis.
- ΔY displayed in the softkey area is the voltage difference C (or 2A) between Y1 and Y2.
- Calculate the phase difference using the formula below.

$$\theta = \pm \arcsin \frac{C}{D} \text{ or } \theta = \arcsin \frac{A}{B}.$$



4. System Message and General Problems

System Message

Function is not available: The control knob, key, or softkey is not available under a specific operating condition. This message will be displayed when you try to operate these knob, key, or softkey.

The control is at its limit: This message will be displayed when the maximum or minimum value is reached by turning the Entry knob, Vertical Control knobs, Horizontal Control knobs, or Trigger Level knob.

Total is at its maximum: This message will be displayed when the maximum value of Total count for PASS/FAIL is reached.

Record is completed: This message will be displayed when the number of waveforms (set in the **End Frame** softkey) have been recorded or when you press the **Operate** softkey to stop the record process manually.

No external memory: This message will be displayed when you

System Message and General Problems

try to save a file to an external mass storage device which has not been installed.

Save error: This message will be displayed when you fail to save a file to the internal or external memory.

Empty storage memory: This message will be displayed when you try to load a file which does not exist from the internal memory.

Unrecognized file: This message will be displayed when you try to load a file which can not be recognized by the oscilloscope from the external memory.

Update failed: This message will be displayed when software update is failed.

No record data: This message will be displayed when you try to save or playback a record without record data.

Record is aborted: This message will be displayed when **Operate** softkey is pressed to stop record process without any waveform data recorded.

Factory setup is recalled: This message will be displayed when the default factory configuration is recalled.

No signal is found: This message will be displayed when you press the **AUTO** key without any signal connected to each

System Message and General Problems

channel.

Invalid data: This message will be displayed when you try to save a *.CSV , *.TRC or *.WFM file without any valid waveform data.

Load finished: This message will be displayed when a file has been successfully loaded from the internal or external memory.

Save finished: This message will be displayed when a file has been successfully saved to the internal or external memory.

Incompatible file: This message will be displayed when the update software is not match with the model type.

Load error: This message will be displayed when you fail to load a file from the internal or external memory.

Restart to complete updating: This message will be displayed to let you restart the oscilloscope when the software update is successfully finished.

USB device is installed: This message will be displayed when a USB device is connected and recognized by the oscilloscope.

USB device is removed: This message will be displayed when a USB device is removed from the oscilloscope.

USB host error: This message will be displayed when the USB

System Message and General Problems

host control circuit is not working normally.

No help file: This message will be displayed when no help file is loaded or the loaded help file is destroyed.

Digital filter is closed: This message will be displayed when digital filter is closed automatically.

System Message and General Problems

General Problems

If there is no display on the screen.

- Check that the power cord is connected to the oscilloscope and to a live power source.
- Check that the power switch is on.
- Check that the display contrast is adjusted properly.
- Contact our engineer if there is still no display.

If there is no waveform displayed.

- Check that the oscilloscope probe lead wires are securely inserted into the connector assembly and that the probe clips make good contact with the probe lead wires.
- Check that the probe clips are securely connected to points in the circuit under test and that the ground is connected.
- Check that the circuit under test is powered on.
- Press the **AUTO** key again.

If the waveform display is not stable.

- Check that the trigger Source channel is actually the channel to which the trigger signal is connected.
- Check that the proper trigger type is selected. Video type is only used to trigger a Video signal. Proper trigger type is essential to acquire a stable display.
- Try to use the HF Reject or LF Reject to reduce the noise of the trigger signal.

System Message and General Problems

If the amplitude is not identical with the actual voltage.

- Check that the attenuation factor of the probe is identical with the attenuation factor set in the channel menu.

5. Specifications and Characteristics

Specifications

All specifications are warranted. Specifications are valid after a 30 minutes warm-up time and within $\pm 5^{\circ}\text{C}$ of last “Self-Cal” temperature.

| | |
|---------------------------------|--|
| Bandwidth | 25MHz: DSO-3022A 60MHz: DSO-3062A 100MHz: DSO-3102A |
| DC Vertical Gain Accuracy | 2 mV/div, 5 mV/div: $\pm 4\%$ 10 mV/div to 5 V/div: $\pm 3\%$ |

Specifications and Characteristics

Characteristics

All characteristics are the typical performance values and are not warranted. Characteristics are valid after a 30 minute warm-up time and within $\pm 5^{\circ}\text{C}$ of last “Self-Cal” temperature.

Vertical system

| | |
|---|--|
| Scope channels | 2 channels plus external trigger input. |
| Bandwidth | 25MHz: DSO-3022A 60MHz: DSO-3062A 100MHz: DSO-3102A |
| Calculated rise time (=0.35/bandwidth) | <14.0ns: DSO-3022A <5.83ns: DSO-3062A <3.50ns: DSO-3102A |
| Coupling | AC, DC and GND |
| BW Limit | 20MHz selectable except DSO-3022A |
| DC Vertical Gain Accuracy | 2 mV/div, 5 mV/div: $\pm 4\%$ 10 mV/div to 5 V/div: $\pm 3\%$ |
| DC Measurement | 2 mV/div to 5 mV/div: $\pm(4\% \times \text{reading} + 0.1 \times \text{V/div} + 0.5 \text{ mV})$ 10 mV/div to 5 V/div: $\pm(3\% \times \text{reading} + 0.1 \times \text{V/div} + 1.0 \text{ mV})$ |
| Position range | ± 8 divisions away from the center of the screen |
| Attenuation factor | $\times 1$, $\times 10$, $\times 100$, $\times 1000$ |
| Channel common mode rejection | 100:1 at 60Hz 20:1 at 10MHz ^[1] |
| Lower frequency limit, AC coupled | $\leq 5\text{Hz}$ at BNC $\leq 1\text{Hz}$ when using a 10X passive probe |
| Channel to channel crosstalk | $\geq 100:1$ at 1MHz $\geq 100:1$ at 10MHz ^[1] |
| Input Impedance | 1M Ω 18pF |
| Maximun input | 400V _{pk} @1M Ω |

Specifications and Characteristics

| | |
|--------------------|--|
| Differential delay | $\pm 150\text{ps}$ when vertical scale and coupling settings are identical |
|--------------------|--|

^[1] Bandwidth reduced to 6MHz with a 1X probe.

Specifications and Characteristics

Horizontal system

| | |
|-------------------------|--|
| Time base range | DSO-3022A: 10 ns/div to 50 s/div, 1-2-5 step DSO-3062A: 5 ns/div to 50 s/div, 1-2-5 step DSO-3102A: 5 ns/div to 50 s/div, 1-2-5 step |
| Modes | Main, Delayed, Roll and X-Y |
| Time base accuracy | $\pm 0.01\%$ |
| Input of X-Y mode | Channel 1 is the horizontal X-axis input Channel 2 is the vertical Y-axis input |
| Bandwidth of X-Y mode | 25MHz: DSO-3022A 60MHz: DSO-3062A 100MHz: DSO-3102A |
| Phase error of X-Y mode | $\pm 3^\circ$ |

Specifications and Characteristics

Measurements

| | |
|---------------------|---|
| Voltage measurement | Max, Min, VPP, High, Low, Amplitude, Average, RMS, Overshoot, Preshoot, Cycle average, Cycle RMS |
| Time measurement | Frequency, Period, Rise time, Fall time, +Width, -Width, +Duty, -Duty, Delay, Phase, X@MAX, X@MIN |
| Math | CH1-CH2, CH1+CH2, CH1×CH2, FFT (1k points) |
| Cursors | Manual, Auto, and Track |
| Counter | Built-in 5-digit frequency counter. Count up to the oscilloscope's maximum bandwidth. |

Specifications and Characteristics

Trigger system

| | |
|--------------------------|--|
| Source | CH1, CH2, EXT, EXT/5, AC Line, Alternating. |
| Modes | Auto, Normal, Single |
| Coupling | DC, AC, LF-Reject, HF-Reject |
| Type | Edge, Pulse, Video |
| Trigger level range | Internal: ± 8 divisions from screen center EXT: $\pm 1.6V$ EXT/5: $\pm 8V$ |
| Trigger sensitivity | 0.1div to 1.0 div user adjustable |
| EXT input impedance | $1M\Omega 18pF$ |
| EXT maximum input | $400V_{pk} @ 1M\Omega$ |
| Video Standard | Supports NTSC, PAL, and SECAM broadcast systems for any field or any line |
| Holdoff Range | 100ns to 1.5s |
| Trigger Level Accuracy | Internal: $\pm 0.3 \text{ div} \times \text{volts/div}$ |
| SET LEVEL TO 50% | Operates with input signal $\geq 50 \text{ Hz}$. |
| Pulse Width Trigger mode | Trigger when Less than, Greater than, Equal, Positive pulse , Negative pulse |
| Pulse Width Range | 20ns to 10s |

Specifications and Characteristics

Storage and I/O

| | |
|-----------------|--|
| Internal memory | 10 setups and trace files can be saved and recalled internally. |
| File format | Setup file(*.STP), Waveform file(*.WFM), Trace file(*.TRC), BMP file(*.BMP), CSV file(*.CSV) |
| Standard ports | USB host USB device RS232C PASS/FAIL OUT |

Specifications and Characteristics

Acquisition system

| | |
|----------------------------|---|
| Max real time sample rate | 400MHz |
| Max equivalent sample rate | 10GHz |
| Memory Depth | Single channel ON: 2.4Mpts Double channel ON: 1.2Mpts |
| Vertical resolution | 8 bits |
| Sample mode | Normal, Average, Peak Detect |
| Autoset | Finds and displays all active channels, sets edge trigger mode on channel 1, set vertical sensitivity on scope channels and time base to display one or five periods. Requires minimum voltage >10mVpp, 0.5% duty and minimum frequency >50Hz. |

Specifications and Characteristics

Display system

| | |
|---------------|---|
| Display | 5.6-inch TFT LCD display. |
| Resolution | 234 vertical by 320 horizontal pixels |
| Colour | 24 bit true color |
| Brightness | Adjustable |
| Language | Simplified Chinese, Traditional Chinese, English, Korean, Japanese, Russian, French, Spanish, Persian, Portuguese |
| Display area | Menu ON: 8 vertical by 10 horizontal divisions or 200 vertical by 250 horizontal pixels Menu OFF: 8 vertical by 12 horizontal divisions or 200 vertical by 300 horizontal pixels |
| Display mode | Vector, Dots |
| Interpolation | Sinx/x, Linear |
| Persistence | OFF, Infinite persistence |

Specifications and Characteristics

Power and environmental requirements

| | |
|---------------------------|--|
| Line voltage Range | 99V to 242VAC |
| Line frequency | 47Hz to 440Hz |
| Power consumption | Less than 50VA |
| Operating temperature | 0°C to 40°C |
| Non-operating temperature | -20°C to 55°C |
| Humidity | Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C |
| Operating altitude | ≤3000m |
| Non-operating altitude | ≤15000m |

Physical size and Weight

| | |
|-------------------|----------------------|
| Instrument height | 156.5 mm |
| Instrument width | 320 mm |
| Instrument depth | 123 mm |
| Net weight | Approximately 2.5 kg |

Calibration interval

| | |
|----------------------------------|----------|
| Recommended calibration interval | One year |
|----------------------------------|----------|